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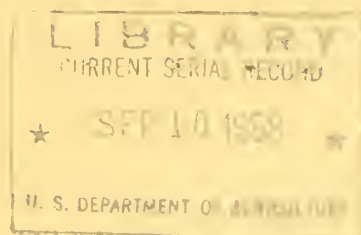


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FEDERAL-GRANT RESEARCH

at the

STATE AGRICULTURAL

EXPERIMENT STATIONS

Projects in

SOILS

Part 21, Section c

Soil Physical Properties,  
Conservation and Classification

Agricultural Research Service  
UNITED STATES DEPARTMENT OF AGRICULTURE

Compiled April 1958 by

The State Experiment Stations Division, Agricultural Research Service, U. S. Department of Agriculture, Washington 25, D. C., for use of workers in agricultural research in the subject-matter areas presented. For information on specific research projects write to the Director of the Station where the research is being conducted.

Issued June 1958

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## INTRODUCTION

This compilation is one of a series providing information on State agricultural experiment station research supported by Federal-grant funds appropriated annually by Congress under authorization of the Hatch Act of 1887, as amended and approved Aug. 11, 1955, and Section 204(b) of the Agricultural Marketing Act of 1946. It is prepared for use by research workers in the subject-matter areas presented. Only that part of each State's research program supported by Federal-grant moneys is included.

In addition to the Federal-grant moneys, the State experiment stations receive some Federal support through cooperative agreements or contracts with the U. S. Department of Agriculture. Information on such research, along with other departmental research, is available in the Central Project Office, Agricultural Research Service.

A substantial part of each State agricultural experiment station's research is supported with moneys appropriated by the respective State or Territorial Legislatures and through other forms of private and public financing. Information on current agricultural research at the stations which is not financed under the Federal-grant program or through USDA cooperation can be obtained from experiment station directors.

The information given in the series of Federal-grant compilations includes the title and objectives of each Federal-grant project pertaining to the subject given on the cover. The identification of each project gives the department(s) conducting the research, the station number of the project, and the number of the regional project if it is a contributing project.

Relevant regional projects, if any, appear at the end of the compilation. States having projects contributing to regional projects are indicated. The Roman numeral (and capital letter) refer to the location in the summary of the contributing project title and objectives. The States are grouped into four major regions. These are designated NC-North Central, NE-Northeastern, S-Southern, and W-Western. The capital letter "M" following the letters for the region indicates regional marketing projects.





## I. PHYSICAL PROPERTIES

A. Soil Water Measurement and Movement

- Ala.            Engineering Phases of Supplemental Irrigation. To (1) determine infiltration rates, retention of moisture available for plant use, and percolation rates of major soil types; (2) establish equipment design factors applicable to supplemental irrigation systems; (3) determine initial cost and operation cost of supplemental irrigation equipment for single and multiple use on the farm; and (4) compare various mechanical and vegetative methods of conserving water from natural rainfall and supplemental irrigation.  
Agr. Engin. 321, Coop. ARS
- Calif.        Dynamics of Water Flow in Saturated Soils, and Its Application to the Engineering Design of Drainage Systems. To improve engineering practice in drainage design through understanding of physical principles of flow of H<sub>2</sub>O thru saturated soil.  
Irrigation 1655 (W-28)
- Colo.        Study of Evaporation from Soil Surfaces in Terms of New Soil and Micro-Meteorological Factors Using a Wind Tunnel. Learn relationship involved in evaporation from soil surfaces in terms of atmospheric factors; surface temperature; boundary roughness, and soil factors, including moisture status, permeability, texture, structure, and cultivation.  
Soils, Agr. Engin. 227 (W-32), Coop. ARS
- Idaho        Soil and Moisture Studies on "Sick" Alfalfa Using Radiotracers. Learn (1) effect of soil moisture and soil physical condition on availability of nutrients; (2) patterns of soil moisture movement to observe moisture penetrability.  
Agr. Chem., Agron. 328
- Ill.         Description of Moisture Conditions and Water Transport in Soils. (1) Examine and evaluate thermodynamics of soil water by giving attention to equilibrium in situations of nonconstant temperature. (2) Develop consistent theory of soil moisture flow for saturated and unsaturated soils, including vapor transfer. (3) Develop method for measuring permeability of unsaturated soils. (4) Study relationship of permeability of soils to pore space geometry, specific surface, moisture content, and other soil parameters. (5) Develop new or improve old methods of characterizing soil moisture in situ.  
Agron., Soils 15-381

Ind. Analysis of the Dynamics of Moisture Flow in Soils.  
 (1) Study flow systems in which saturated & unsaturated flow occurs simultaneously. (2) characterize mathematically the infiltration process for soil. (3) develop improved mathematical equation for characterizing flow of water in unsaturated soils.

Agron. 849

Ind. An Evaluation of the Amount of Available Water in the Irrigable Soils of Indiana. (1) Obtain a measure of available water holding capacity of irrigable soil of Indiana. (2) Evaluate relationship between pore size distribution & yield response to irrigation.

Agron., Ag. Eng., 858

Iowa Movement of Water and Gases in Soil, and Their Relation to Other Physical Properties. To (1) study water and gas movement in soil in relation to drainage and aeration, (2) predict watertable behavior in soils, (3) obtain mathematical formulas for movement of water into artificially made soil cavities, and show application to the measurement of hydraulic conductivity of soils, (4) study mass type flow and diffusion type flow of gases in soils and apply the solutions to soil aeration and methodology, (5) improve neutron scattering device for measuring soil moisture and incorporate into the device a means of measuring soil density by gamma ray absorption, (6) develop theories for using tagged atoms in studying transfer rates of water, gases, ions, etc., in soil, (7) study use of radioactive water in tracing water from different sources into plants.

Agron., Engin., Phys. 998

Iowa Development of Portable Equipment and of Methodology for Predicting Rates of Water Infiltration into Soils. (1) Develop a portable rainfall simulating infiltrometer which could be used throughout the region in making predictions of rates of infiltration of water into soil. (2) Obtain data regarding influence of antecedent moisture, plant cover, soil properties, & rainfall intensity on infiltration rates of water into soils. (3) Learn possible correlations between infiltrometer data & runoff data obtained under natural rainfall on small plots & watersheds in Iowa & elsewhere in the region.

Agron., Ag. Engin., 1356

Mich.

The Development of Methods for Measuring Moisture and Temperature in Soils, Air and in Other Situations. To measure (1) moisture content of the soil; (2) relative humidity of the air; and (3) soil temperature.

Soil Sci. 2

Minn.

Soil Moisture Investigations Relating to Internal Drainage and Supply of Water for Crop Production. To (1) supply information useful in increasing efficiency of drainage and irrigation practices, and (2) improve and develop new criteria and methods for estimating need for and possible returns from control of excess and deficiency of moisture.

Soils 2519

Mo.

Use of Water in Production of Agricultural Crops.-- Infiltration Rates and Available Water Capacity for Major Soils of Missouri. To assemble equipment and develop methods for determining (1) optimum rate of water application for different soil areas of the state; and (2) available water capacity of principal soil areas of the State.

Soils 211, Coop. ARS

Mont.

Efficiency of Water Storage and Use for Crop Production in Semi-Arid Areas. To (1) determine soil factors which influence amount and rate of water loss from soils due to evaporation, and seasonal patterns of upward and downward flow of water vapor thru soil mass associated with temperature differences; (2) determine factors influencing rate and amount of water flow over short distances in soil, e.g., to germinating seeds or growing roots; (3) determine to what extent the depth at which moisture is stored in soil influences efficiency of its use by plants; and (4) devise methods of increasing efficiency of water use for plant growth.

Agron. Soils, Chem., Engin. 145, MS 935, (W-30)

Nebr.

Soil Moisture Relations in Nebraska Soils. To determine (1) relationships of moisture constants for Nebraska soils; (2) effects of exchangeable cations on the physical conditions of soils as they affect the water-soil relationships; (3) effects of natural and synthetic organic matter on physical condition of soils as they affect the water-soil relationships; (4) types of clay minerals in soils as they affect the moisture relations of soil; and (5) permeability of fluids in different soil types.

Agron. 310, coop. ARS, USDI-Bur. of Reclam.



N. C.

The Interrelationships of Soil Physical Properties and Soil Water Movements. To (1) determine draw-down patterns of water table by use of an electric analogue; (2) attempt to measure hydraulic conductivity of undisturbed soil cores and to relate it to soil properties; and (3) study nature and magnitude of forces holding water films on clays, and to relate these to hydraulic conductivity.

Agron., Soils 119

Oreg.

Soil Moisture: Its Measurement, Movement, and Availability to Plants in Unsaturated Soils. To (1) theoretically and experimentally study range of validity of capillary theory as it applies to water in unsaturated soils; (2) evaluate importance of findings from (1) in terms of availability of soil water to plants and moisture movement in unsaturated soils; (3) study influence of soil-moisture tension on aeration status of a soil; (4) critically examine upper limit of available moisture range used in calculating moisture storage capacity of field soils; and (5) study new methods of measuring soil moisture.

Soils 174 (W-29)

Oreg.

The Development of a Method for Maintaining a Constant Moisture Content During Plant Growth. (1) Develop method and equipment for applying moisture uniformly to a soil at a moisture content below field capacity by supplying moisture in vapor phase. (2) adapt method and equipment to maintenance of a steady moisture content in soil while moisture is being extracted by plants. (3) learn permissible range of operating conditions for method as governed by psychrometry and heat flow characteristics of system and by plant physiological characteristics. (4) Use method and equipment to learn effect of soil moisture tension on consumptive use rate of a plant. (5) Use method to study effect of soil moisture tension on other plant physiological processes if first objectives are successfully attained.

Ag. Engin. 361, coop. ARS (W-28)

Pa.

Methods and Equipment for Measuring Soil Moisture to Determine the Need for Irrigation. Formulate system for learning when and how much to irrigate, employing consumptive use, weather records and soil moisture measurements with special emphasis on an evaluation and improvement of available instruments for measuring soil moisture.

Agr. Engin. 1152-E (NE-22)

S. C.

Relation of the Physical Properties of Soils to Infiltration Rates, Evapo-Transpiration Rates, and Irrigation Requirements. To learn (1) effects of crop rotation and other cultural practices on infiltration rates of soils, (2) influence of physical properties of different soil types on infiltration, (3) relation of clay mineral composition of selected soil types to moisture characteristics and other physical properties, (4) relation of physical properties of selected soil types to evapo-transpiration rates using certain commonly grown plants, (5) influence of physical properties of soil, climate, and cultural practices on irrigation requirements of selected crops.

Agron., Soils 37, Coop. ARS

Tenn.

Moisture Sorption Characteristics of the Major Soils of Tennessee and the Relation of Moisture Tensions to Plant Growth and Fertilizer Utilization. To (1) determine moisture sorption curves for major soil types of Tennessee; and (2) evaluate optimum soil moisture tensions for major crops in relation to irrigation and fertilization practices.

Agr. Eng. 28 Coop. ARS, TVA (S-24)

Wash.

Fundmental Study of Soil Moisture Dynamics and Statics. To (1) study thermodynamic theory of and techniques for measuring energy status or tension characteristics of moisture in soil; (2) study mechanics of moisture movement & intake in soils under unsaturated conditions; to develop quantitative expressions, analytic or empirical, for such movement and intake, and develop methods for evaluating parameters of flow and intake equations; and (3) develop methods for application of energy relationships and equations of moisture flow and intake to solution of agricultural problems involving soil moisture.

Agron. 1219 (W-29)

Wash.

Soil Moisture Measurement by Neutron Scattering. To develop techniques and evaluate methods for measuring the moisture content of the soil using neutron scattering under field and lab conditions.

Agron. 1234, Coop. ARS

Wis.

Soil Water Movement: Principles, Measurement, and Relation to Plant Growth. To (1) measure water movement in both saturated and unsaturated Wisconsin soils; (2) investigate principles of water movement; (3) investigate relation of water movement to other physical properties of the soil and to plant growth; and (4) apply measurements to better use of land and water in agriculture.

Soils 855

## B. Water-Plant Relationships

Ala.

Effects of Variations in Soil Moisture and of Different Lengths of Drought on Yield and Grade of Selected Vegetable Crops. To determine effect of (1) variations in range of soil moisture on yield and grade of vegetable crops; and (2) periods of drought of different durations at different times during life of vegetable crops on yield and grade of the crops.

Hort. 317

Ariz.

Culture and Water Economy of Soil Improving Crops.

(1) Develop cultural practices for establishing a vegetative cover on irrigated farm land released from cultivation in southern Arizona. (2) Learn minimum amounts of irrigation water necessary for survival of a desirable plant cover and the efficiency of use of this water in forage production. (3) Learn residual effect of cover crops on soil fertility and physical characteristics.

Agron., Rge. Mgt., Engin., Chem. 402. Coop. ARS, SCS

Ark.

Studies of Physiological Factors that Influence Water Needs and Use in Production of Horticultural Crops.

To (1) study methods of determining soil moisture in an attempt to find or develop a reliable and efficient technique for use in these studies and for grower use; (2) determine range of available soil moisture permitting optimum growth and fruiting of plants, and if this range varies for different stages of plant development; (3) determine relation between nutrient use and moisture ranges for horticultural crops; and (4) study relation between temperature, optimum soil moisture range and frequency of water application.

Hort., For. 388

Ark.

Studies of Physiological Factors Affecting the Growth of Agronomic Crops Grown Under Irrigation. To (1) determine

critical time intervals of moisture stress which may affect yield and quality of certain selected agronomic crops (2) learn water needs of agronomic crops under varied levels of soil fertility, moisture conditions and stages of plant growth, (3) learn effect of supplemental irrigation on date and length of fruiting periods, maturity date, yield, and composition of agronomic crops, (4) study effect of soil and air temperatures, and relative humidity as modified by supplemental irrigation on physiological responses of the agronomic crops, and (5) learn possible effects of deposits of Fe and Mn from sprinkler applied irrigation water upon the physiology of some agronomic crops.

Agron. 392



Calif. Relation of Soil Moisture Conditions to the Physiology of Plants. To (1) develop means of relating measurable soil moisture stress conditions within root zone to effective moisture stress in the plant; (2) study effects of moisture stress on root functioning and rate of elongation; (3) determine relative effects of increasing moisture stress on various aspects of plant functioning and growth; and (4) investigate influence of environmental conditions on relations between soil moisture stress and plant growth.

Irrig. 1582 (W-29)

Calif. Factors in Watershed Management that Influence the Disposition of Precipitation and Yield of Water. Study factors influencing precipitation disposition with emphasis on vegetation management as a means of increasing water yields.

Soils, Agr. Engin. 1658 (W-32)

Conn. Effect of Soil Properties on the Yield and Quality of Tobacco Grown Under Irrigation. To learn (1) interrelation of irrigation, soil type, physical soil condition, fertilization, row spacing, kind of tobacco, and nature of tobacco root system on yield and quality of tobacco; (2) effect of deepening effective tobacco root zone (by loosening and fertilizing subsoil) on more efficient use of water applied by irrigation in increasing yield and quality of tobacco.

Soils 724 (NE-22)

Storrs  
(Conn.) Soil-Plant-Water Relationships of Vegetable Crops. To (1) formulate a practical system of predicting need for irrigation of vegetables, and indicate methods of using limited water efficiently; (2) identify critical growth periods in various vegetables when irrigation or lack of it may be beneficial or detrimental; (3) ascertain influence of specific elements in humid climate on use of water by vegetables; (4) note effect of irrigation on vegetable quality at harvest and during storage; and (5) explain differential response of vegetables to varying levels of irrigation in terms of plant physiological processes and soil physics phenomena.

Soils 224 (NE-22)

Del. Irrigation on Vegetable Crops. To (1) learn effect of irrigation on yield and quality of important vegetable crops when water is applied at various levels of soil moisture depletion and different physiological stages of plant growth, (2) investigate interactions between irrigation and other cultural practices, emphasizing nutrient supplying practices, control of plant diseases, and chemical applications for weed control, (3) formulate practical method for irrigation program by using soil moisture measurements, weather records, consumptive use data and rooting depth measurements.

Hort. 52-H (NE-22)

Ga. The Effect of Different Moisture Levels on Rates of Evapotranspiration from Row Crops in the Piedmont of Georgia. Learn (1) response of cotton to three soil moisture regimes under completely adequate and normal fertilization, (2) rate of evapotranspiration from cotton grown with irrigation.

Agr. Engin., Agron 310 (S-24) Coop. ARS

Hawaii The Growth of Saccharum Officinarum as Affected by Environmental Conditions with Special Reference to Moisture. To (1) continue studies toward refining the concept of fitting crop growth to environment; (2) to work out a formula for the control of moisture relations of sugarcane through irrigation based on the physiological status of the plant in relation to atmospheric conditions, soil moisture, and fertilization.

Pl. Phys. 653-1

Idaho Irrigation of Bean Seed Crops. To (1) determine optimum frequency for irrigation of bean seed crops, (2) determine relationships between irrigation treatments, varieties, and plant spacing, (3) determine effect of experiment variables of items 1 and 2 on a. bean diseases including Sclerotinia, Pythium, and Fusarium root rot, and b. maturity date, and (4) test several types of soil moisture measuring devices for accuracy in determining soil moisture content.

Agr. Engin. 251, Coop. ARS

Ill. Soil Moisture as a Factor in the Growth and Yield of Corn. To (1) obtain quantitative information on relation between different levels of soil moisture deficiency and growth and physiologic behavior of corn at different growth stages; (2) determine efficiency of water use by corn at different levels of soil moisture deficiency under fertility conditions and plant populations conducive to high yields; and (3) relate water use by corn to open-pan evaporation and other climatic characteristics.

Agron. 15-373

Ill. Moisture Utilization by Fruit Crops. To learn effect of (1) supply of available soil moisture upon vegetative and reproductive responses of fruit plants, (2) fruit production practices upon efficiency of utilization of soil moisture supply, (3) environmental factors upon soil moisture supply as related to fruit production.

Hort. 65-311



Ind. Irrigation of Forage Crops in Indiana. Learn (1) water requirements of various crops of state and their responses as to yield, quality, and degree of disease under different soil moisture conditions, (2) effect of various soil moisture conditions on root growth and nutrient uptake.

Agron., Bot., Agr. Engin. 823

Iowa Soil and Climate Factors Affecting the Efficient Use of Water by Crops. To (1) determine moisture properties of Iowa soils (moisture holding capacity, wilting point, available soil moisture), (2) determine evapo-transpiration of different major crop covers on different soils under different weather conditions (particularly on corn), (3) investigate rate of replenishment of soil and subsoil moisture in relation to climate-crop factors, rainfall, evapo-transpiration, runoff, crop cover, and mulch, (4) develop a technique for estimating soil moisture over large areas from meteorological data and from limited soil moisture samples, (5) determine optimum soil moisture range for crop growth at different growth periods, under different air temperature conditions, (6) obtain moisture data at specific locations and times, for use in agronomic interpretations, and (7) determine root distribution and development under different subsoil moisture conditions.

Agron. Soil, Agr. Engin. 1276, Coop. ARS, Dept. of Commerce--WB

Kans. Ecological Studies of Grasslands and Other Areas. To study some aspects of community dynamics, with special emphasis on the soil moisture relationships.

Bot. 435

Md. Engineering, Soil, and Plant Aspects of Supplemental Irrigation. To determine (1) N retention in soil and its availability to plants as related to various irrigation and fertilizer practices, (2) interrelationships of crop species, rooting habit and certain cultural practices to yield and quality of agronomic crops as influenced by irrigation, (3) effects of irrigation on yield and quality of selected vegetable crops of importance in Maryland and the region, (4) interrelationships of supplemental irrigation, fertilizer, and other cultural practices in their effects on yield, quality and mineral nutrient content of vegetable crops, (5) rate of use of soil moisture by vegetable crops at various stages of growth and under varying climatic conditions, and (6) effects of frequency of irrigation, amount of water, starting time of irrigation and distribution methods with specific reference to first five objectives.

Hort., Agron., Engin. BOQR-83 (NE-22)

Mass.

Cranberry Bog Moisture Relation Studies.--1. Drainage of Cranberry Bogs.--2. Irrigation of Cranberry Bogs. To (1) drain cranberry bogs; (2) explore the field on cranberry bog irrigation; (3) determine optimum needs of cranberry vines at various stages of growth; (4) determine supplementary value of irrigation systems in frost protection, liquid fertilizer distribution, and insect control; (5) determine value of watering immediately after harvesting in assisting the vines to withstand or recover from bruising and partial uprooting caused by picking.

Cran. 117

Mass.

Movement and Importance of Vaporous Soil Moisture Under Various Turf Grasses. To obtain information on (1) magnitude of vaporous water movement in soil under controlled lab and greenhouse conditions and under uncontrolled field conditions as influenced by different turf species and varying heights of cut; (2) extent to which turf can survive on moisture supply in vaporous form; (3) movement of water in vapor phase in several soils; and (4) effect of varying kinds of turf and heights of cut on soil temperature and moisture in liquid phase.

Agron. 9

Mich.

Water Requirements of Crops. To determine (1) use of water by crops, as influenced by climate, soils and farming practices; (2) basic relationships between soil moisture and crop production; (3) optimum growth conditions for crops under various irrigation, fertilizer and management practices, (4) proper irrigation equipment design principles and operational practices as affected by peak moisture use, crop rooting habits, fertilizer practices and other design factors.

Agr. Eng., Hort., Fm. Cps., Soil Sci. 805

Miss.

Soil Moisture as Related to the Production of Agronomic Crops. To learn (1) the rate of evapotranspiration from crops grown under different soil moisture regimes at this location; (2) relationship between soil moisture regime and crop yield; (3) how plant development and crop yield are affected by increasing or decreasing soil moisture tension at definite plant morphological stages; (4) at what plant morphological stages are increasing or decreasing soil moisture tensions important; (5) the effect soil moisture regime applied to crop has on rooting habits.

Agron., Soils HD-8, Coop. ARS

Mo.

The Use of Water in the Production of Agricultural Crops. To (1) determine physiological effects of application of water to different species of plants at different stages in their growth; (2) develop reliable criteria for determining when various species will benefit from water; (3) study response of different varieties to particular levels of available soil moisture; (4) determine possibility of lowering rate of transpiration of various crops; (5) determine influence of fertility level on yield and quality of crops grown under various soil moisture levels; (6) determine optimum rate and amount of water application for various soils to be irrigated; (7) determine effect of irrigation on physical and chemical characteristics of various soils; (8) study changes in management practices, such as disease and insect control, made necessary by use of additional water in crop production; (9) determine present sources of water and develop design data for surface reservoirs as source of irrigation water; (10) adapt existing methods and develop better ones for irrigating under humid conditions, (11) integrate use of irrigated pastures into livestock production; and (12) make case studies with farmer cooperators on costs and benefits of irrigation.

Hort. 1

Mont.

Soil-Water-Plant Relations of Forage Crops with Different Water Table Levels. To determine (1) influence of different water table levels and other water management procedures on production and quality of hay and pasture on high altitude meadows; and (2) determine best fertilizer practice, soil amendments and cultural practices for maximum economic production of pasture and hay under various water management practices.

Agron., Soils MS 918, (W-29)

Nebr.

The Relationship Between Meteorological Factors and the Rate of Water Use by Corn. (1) Relate evapotranspiration, meteorological phenomena, and physical characteristics of the soil to crop response, (2) develop a water use equation for calculating irrigation needs of corn.

Agr. Engin. 570 (NC-46)



Nev.            Comparative Irrigation Requirements and Crop Yields, Under High Water Table Conditions, of Pasture Grasses and Legumes with Normally Different Average Rooting Depths.  
To learn, under high water table conditions, for different pasture grasses and legumes (1) comparative quantitative seasonal irrigation requirements, (2) comparative required irrigation frequencies, (3) comparative yields under irrigation regimes, (4) comparative water use efficiency of plants studied, in terms of dry weight yield versus weight of water applied.  
Fm. Dev. 22, Coop. ARS

Nev.            Water Studies in Relation to Forage Crop Production in Southern Nevada. To determine (1) basic consumptive use of more important forage crops grown in Nevada, and (2) irrigation efficiencies practical and feasible under southern Nevada conditions.  
Agron. 89, Coop. ARS

N. H.           Water and Fertilizer Requirements of Selected Crops and Soils as Related to Supplemental Irrigation. To determine (1) need for irrigation and provide hydrological data by analysis of precipitation data for designing an irrigation system, (2) moisture-release curves for soils representative of New England, (3) effect and interactions of rates of irrigation and rates of fertilization needed for economic production of forage crops and potatoes, and (4) effect of supplemental irrigation on the movement of applied fertilizer in the soil profile.  
Agron., Engin. 99 (NE-22), Coop. ARS

N. J.           Soil-Plant Water Relationships as a Basis for Irrigation.  
To learn (1) water needs of crops under different environments, (2) response of different crops to supplemental irrigation at certain growth stages and under various soil moisture deficiencies, (3) means of increasing efficiency of water used by plants, (4) method of knowing when to irrigate certain crops, (5) infiltration capacity, texture, structure, permeability, total and available water holding capacity and moisture release characteristics of each of significant layers within or immediately below profile, (6) effect of irrigation on physical properties of soil, (7) crop tolerance to soluble salts and other substances in irrigation water, and long and short term effect on physical, chemical, and biological characteristics of soils.  
Soils, Agr. Engin. 646 (NE-22), Coop. ARS

N. Mex.

Water Requirements of Cotton (Extra-Long Staple, and Upland, Acala 1517C) Grown on Light-Textured to Medium-Textured Soils in Mesilla Valley, New Mexico.

To determine (1) desirable frequencies of irrigations for cotton production, (2) desirable range of depths of irrigation applications for optimum production with limited, and an adequate water supply; (3) effect of variable depth irrigation applications; (4) utility of electrical resistance blocks as a suitable method for determining "When to irrigate"; and (5) relative use of water by single beds as compared to double beds with furrow irrigation.

Agr. Engin. 41

Ohio

Factors Affecting Growth and Mineral Absorption by Plants. Mineral Absorption by Plants in Relation to the Soil Moisture Supply. Study nutrient accumulation in plants in relation to soil moisture content and soil moisture tension in the range of wilting point to saturation.

Agron. 1-3

Ohio

Interrelation of Frequency of Irrigation and Rate of Application of Nitrogen Fertilizer on the Yield and Quality of Potatoes Grown on Sandy Loam. To determine (1) at what soil moisture level irrigation should be applied to obtain maximum yield of Irish Cobbler potatoes, how rapidly moisture is extracted, how frequently and in what volume water needs to be applied; (2) how much N is needed in fertilizer for irrigated and unirrigated potatoes; (3) effect of irrigation and N supply on specific gravity and quality of potatoes for potato chips; and (4) compare varieties grown on productive soil under large scale methods of culture and irrigation.

Hort. 100, Coop. ARS

R. I.

The Effect of Supplemental Irrigation on the Yield and Quality of Irish Potatoes. To (1) determine at what level of soil moisture supplemental irrigation should begin for maximum yields, (2) determine amount of irrigation water needed to bring soils from initial moisture levels to field capacity, (3) learn how often to irrigate to keep moisture within the selected moisture range, (4) learn adjustment of fertilizer practice needed when using supplemental irrigation for potatoes, (5) learn the adjustment of fungicide and insecticide use that will be needed with supplemental irrigation, (6) study local rainfall data with reference to irrigation needs as determined in this experiment, (7) compare some commercial devices for measuring soil moisture with the dry weight laboratory method.

Agron., Pl. Path., Ent., Ag. Chem. 208, (NE-22)

Utah

Consumptive Use of Water and Irrigation Requirements in the Bonneville Basin of Utah. To (1) obtain basic information on consumptive use of water by agricultural crops, pastures, and native vegetation; and (2) study methods of measurement of consumptive use of water.

Irrig., Drainage 392, Coop. ARS

Vt.

Movement and Retention of Water in Various Soil Types as Related to Supplemental Irrigation. To learn ability of representative soil types to absorb and retain water by supplemental sprinkler irrigations in improved pastures and strawberry fields; and to measure crop responses to irrigation in terms of yield, quality, and botanical composition in pastures.

Agron., Hort. 27 (NE-22), Coop. SCS

Wis.

Evapo-Transpiration from Crops Under Supplemental Irrigation: Its Measurement for Control of Irrigation and for Evaluating Water Conserving Practices. To investigate suitability of evapo-transpiration measurements for controlling amount and frequency of supplemental irrigation applications and to measure conservation of water by crop management practices designed to decrease evapo-transpiration.

Soils 855-Sub.

Wyo.

Irrigation Criteria for Forage Crops. To determine (1) maximum tension to which soil at particular depth may dry without significantly reducing forage yield; (2) at which horizon yield most closely correlates with mean peak tension; and (3) effect of deep phosphate placement on moisture removal from subsurface horizons, and any change in relation of tension to yield for specific horizons.

Agron. 558, (W-29)

### C. IRRIGATION

Alaska

Irrigation Factors and Costs in Alaska. To (1) construct experimental irrigation systems including development of local water sources, (2) investigate feasibility of sprinkler irrigation and its effect on water resources, (3) determine interaction of selected crops (grass, potatoes, vegetables) under different management practices to sprinkler irrigation, and (4) calculate economic factors involved in irrigating crops.

Agr. Engin. 30, Coop. SCS, USDI-Geo. Svy.



Ariz.

Sprinkler Irrigation Studies Under Arid Southwestern Conditions. To determine (1) combined losses from evaporation and drift with commercial type sprinkler heads; (2) losses by evaporation from wetted foliage and soil surface; (3) limiting rates of application and relation to fineness of spray on soils with low infiltration rates; (4) adequacy and uniformity of distribution as affected by interception by foliage in irrigation of citrus; and (5) to study other factors in the economics of sprinkler irrigation.

Hort., Agr. Engin. 303

Ark.

Supplemental Irrigation Investigations with Horticultural Crops. To (1) study influence of varied water sources on soil condition and crop response with particular reference to sources with high salt content, and determine if such waters can safely be used under any conditions of horticultural production; (2) measure value of supplemental irrigation in terms of yield and quality of horticultural crops now generally produced in Arkansas; (3) determine if supplemental irrigation can be used in developing production of new horticultural crops in Arkansas; and (4) study possible changes that may be needed in management program of irrigated crops, such as planting dates, varieties, and disease and insect control.

Hort., For. 310

Ark.

Supplemental Irrigation Investigations with Agronomic Crops. To (1) evaluate methods of learning critical soil moisture levels for irrigation, (2) learn optimum rate and grade of fertilizer and optimum time and method of application for agronomic crops grown under irrigation on major soil types of state, (3) evaluate yield responses of certain selected agronomic crops when irrigation is by sprinkler and furrow methods, (4) learn effect of plant population, planting dates, and other cultural management practices that may have possibilities of influencing degree of response of agronomic crops to supplemental irrigation, (5) evaluate effect of land leveling operations required for furrow irrigation on soil fertility properties of soil and resultant yield of certain agronomic crops, and (6) study methods of increasing infiltration rate of irrigation water into soil in which rate is slow.

Agron. 311

Ark.

Engineering Phases of Irrigation in Arkansas. (1)

Learn rates at which water may be applied to various soils on which crops are growing. (2) Evaluate and develop devices used to learn when to irrigate. (3) Determine irrigation efficiency in terms of quantitative measurements of water distribution, losses and application. (4) Evaluate systems of irrigation with respect to labor requirements, topographic conditions, power and equipment requirements, and efficient water use. (5) Learn mechanics involved in controlling air temperatures with sprinkler irrigation systems.

Agr. Engin. 312

Ark.

The Economics of Supplemental Irrigation of Dryland

Crops in Humid Areas. To (1) determine input-output data for various crops by systems of irrigation, depth and source of water supply, and by various soil series; (2) analyze problems that develop either as a direct or indirect result of adoption of irrigation practices; (3) analyze changes in enterprise combinations and practices that are encouraged by supplemental irrigation of dryland crops; and (4) evaluate use of various irrigation systems by crops and physical conditions for each area of the State.

Agr. Econ., Rur. Soc. 386

Calif.

Soil Physical Conditions in Relation to Irrigation.

To (1) develop and improve techniques for characterizing soil physical properties; (2) evaluate role of the variables which influence distribution and utilization of water in soil; and (3) use existing methods to evaluate effect of soil management practices on soil physical conditions.

Irrig., Soils 1546

Calif.

Inorganic and Organic Impurities of Irrigation Waters

Affecting Soil Properties and Plant Growth. To determine effects of dissolved and suspended mineral and organic materials contained in irrigation waters on soils and plants including: 1. effects of kinds and concentrations of salts on soil structure and penetration of irrigation waters into soil; 2. effects on plants of materials dissolved in irrigation water; 3. degree of accumulation of harmful salines in soil; and 4. suitability of sewage effluents and drainage waters as irrigation waters.

Irrig. 1529

Colo.

The Influence of Irrigation Practices on Soil Structure

and Plant Growth. To learn effect of methods of (1) application of irrigation water on moisture distribution, surface crusting, and plant emergence and growth; (2) land preparation for irrigation and effect of subsequent tillage operations on soil tilth.

Agron., Agr. Engin., Soils 17



Colo.      Sealing of Irrigation Canals by Sedimenting with Colloidal Clays. (1) develop practical low-cost methods of sealing irrigation canals with colloidal clay sediments carried into place by flowing water. (2) evaluate sealing methods in terms of cost, adaptability to old and new canals, reliability, limits of practical application, and permanence. (3) evaluate other benefits of sedimenting with colloidal clay materials including stabilizing effects on sandy canal bed materials.  
Civ. Engin. 108, Coop. ARS, USDI-Bur. of Reclam.

Colo.      Irrigation Water Application and Drainage of Irrigated Lands in the Upper Colorado River Basin. To (1) study drainage characteristics of irrigated hydrologic unit by investigating general hydrology and drainage properties of its soil mantle to develop methods of diagnosing drainage problems or potential problems; (2) develop methods and equipment to study more efficiently the drainage properties of soil mantle; (3) study relationships of irrigation and water application practices to free ground water as means to reduce and prevent drainage problems; and (4) develop improved methods for selecting best treatment in relation to existing or potential water management-drainage problems.  
Engin., 223, Coop. ARS, (W-28)

Ga.      Soil Physical and Chemical Studies as Related to Supplemental Irrigation of Field Crops. Obtain data on soils of Coastal Plain area of Georgia useful for determining most efficient and economical supplemental irrigation practices for crops.  
Soils, Agron. 207, Coop. ARS

Ga.      The Relation of the Physical Conditions of Piedmont Soils to the Results Obtained from Supplemental Irrigation. (1) Learn effects of irrigation and certain cultural practices on: moisture retention characteristic of soil, moisture intake and transmission characteristic of soil, aeration characteristic of soil, mechanics of soil moisture. (2) evaluate accuracy and reliability of existing moisture measuring devices.  
Agron., Soils 313, Coop. ARS,

Idaho      The Mechanics of Water Control of Steep Irrigated Lands. To (1) test characteristics and effectiveness of water-control devices; (2) evaluate resistance to erosion of soils subjected to various cultivation techniques; and (3) develop improved devices and techniques to control erosion, and increase efficiency of water use.  
Agr. Engin., Agron. 288, Coop. ARS, (W-28)

- Ill.            Irrigation of Farm Crops on Upland Soils of Southern Illinois or Irrigation of Pasture and Corn. To study (1) desirability of supplemental water for production of pasture and corn; (2) supplemental feeding of beef animals on pasture.  
Agron.        40-319 (Dixon Springs)
- Kans.           Effect of Irrigation on Soil Properties. (1) Evaluate effect of irrigation water quality on physical and chemical properties of soil under varying soil and climatic conditions peculiar to Kansas. (2) Learn causes of declining production in irrigated lands and find means of correcting these conditions. (3) Formulate sound principles on which to base irrigation practices and on which land and water may be evaluated to learn its potential for economic crop production.  
Agron. 525
- Maine           Efficient Utilization of Irrigation Water. To (1) learn total water needs as well as critical moisture period during growing period of crops; (2) make soil moisture analysis on soils of different texture which can be used in designing and utilizing irrigation installations.  
Agron., Agr. Engin. 59, (NE-22)
- Mass.           Irrigation Studies and Management of Irrigated Soils. To determine (1) method of supplemental irrigation suited to various crops, (2) agronomic practices best suited to crops with supplemental irrigation, (3) effect of irrigation on maintenance of soil structure, tilth, and soil organic matter, as well as temperature, micro-organisms and disease control, and (4) cost of installation and maintenance of supplemental irrigation systems.  
Agron. 6
- Mass.           Effects of Supplemental Irrigation on Various Soils and Crops. To learn (1) rates and frequencies of irrigation as they are related to various soil types and various crops, (2) effective root zones of various field, vegetable, and forage crops; and relate findings to irrigation recommendations, (3) soil compaction as related to irrigation and yields of various crops.  
Agron. 12, (NE-22)

- Miss.      The Effect of Supplemental Irrigation on Crop Production and Soil Properties in Mississippi. To determine (1) value of supplemental irrigation in terms of economic yield and quality of various crops, (2) optimum rates and frequency of irrigation, (3) most satisfactory and economical methods of applying irrigation water including cost of various methods, (4) effect of irrigation on physical and chemical properties of soils, and (5) effect of supplemental irrigation on incidence of weeds, insects, and diseases.  
Agr. Engin. HB-4
- Miss.      Development of Water Resources for Irrigation. Learn (1) potential ground water supply for irrigation for various areas, (2) maximum area that could be safely irrigated for a group of streams without impairing for other uses, (3) hydrologic characteristics of watershed to predict more accurately quality of water available for farm ponds that could be used for irrigation.  
Agr. Engin., Soils RRFB-2, Coop. USDI-Geo. Svy. (S-24)
- Miss.      The Value of Irrigation in Maintaining Year-Round Pastures of High Quality. To determine value of irrigation in terms of economic yield and quality of forage by: (1) obtaining stands in drought periods; (2) determining optimum rate and frequency of application of irrigation water to maintain production; (3) determining best fertilizer rates and analyses to be used with irrigation; (4) period and amount of production of various forages to maintain continuous production of high quality forage; and (5) effect of irrigation on incidence of diseases, insects, and weeds.  
Agron., Crops HC-16
- Mo.      Storage and Use of Surface Runoff for Irrigation. To determine (1) amount of runoff to be expected for different drought frequencies for the three general soil permeability areas of Missouri; (2) losses by evaporation and seepage from farm reservoirs and methods for reduction of losses; and (3) effect of irrigation on rate and amount of runoff and on soil loss.  
Agr. Engin. 227, Coop. ARS
- Mo.      Distribution and Application of Irrigation Water. To (1) determine adaptability and efficiency of different methods of applying water to different crops on the principal soil areas, (2) develop design criteria for furrow irrigation, and (3) develop improved equipment and methods for applying irrigation water to tall growing row crops.  
Agr. Engin. 265, Coop. ARS



- Mont.      Efficient Application of Irrigation Water. Increase efficiency of irrigation with furrow and flooding methods by reduction of surface runoff and percolation losses. Learn relation between size of stream and length run for different conditions of soil and slope for most efficient application of water. Learn effect of rate of infiltration on size-of-stream length-of-run relationship.  
Agr. Engin. M. S. 973, Coop. USDI-Bur. of Reclam. (W-28)
- Nebr.      Water, Soil and Plant Relationships in Crop Production on Irrigated Lands in Nebraska. To (1) obtain topographic, soils and geological data basic to the design and operation of experimental plots for studies of soil-water-plant relationships, (2) develop plans and provide cost estimates for grading the land area, providing water conveyance and measuring systems, and providing equipment for measuring water and soil loss for the plots, (3) install or guide installation of equipment and facilities, (4) study methods of application of irrigation water, taking into consideration source, "peak demand," supply, soil type, topography, etc., (5) determine optimum use and efficiency of irrigation water in relation to seasonal requirements, adequate soil management and cultural practices, and (6) develop optimum fertility, rotation, tillage and management practices capable of achieving high levels of crop production and maintaining soil productivity under systems of irrigated agriculture.  
Agr. Engin., Agron. 352, Coop. SCS
- Nebr.      Methods and Costs of Distributing Irrigation Water on Rolling Land in the Republican Valley. Learn costs and benefits of irrigating land by methods suited to rolling land as: level benches, gradient benches, contour furrows, and sprinkler irrigation.  
Agr. Econ. 529, Coop. SCS, Ext. Ser., USDI-Bur. of Reclam.
- N. C.      Pasture Irrigation. To (1) study feasibility of irrigating pastures under soil and climatic conditions existing in North Carolina; (2) investigate effect of irrigation upon nutritive value and productive capacity of pastures; (3) study effect of irrigation upon management and fertility requirements of some pasture plants and mixtures of plants; (4) develop methods and determine best systems of irrigating pastures; and (5) determine design requirements for irrigating equipment.  
Agron., Anim. Indus. 10

N. Dak.

Effect of Quality and Management of Water on Physical and Chemical Properties of Selected Soils Under Irrigation. To (1) determine effect of irrigation water of variable quality on physical and chemical properties of a number of soils; and (2) obtain information that will afford a sound basis for use of available water for sustained irrigation.  
Soils 15-4

Okla.

A Study of the Effect of Irrigation Water on Soil Fertility, Soil Structure, and Crop Performance. To determine (1) fertility level necessary to secure maximum returns from irrigation on some major crops, (2) effect of variable quantities of irrigation of different qualities on chemical and physical properties of the soil and the yield of alfalfa over a period of years, (3) effect of additives, natural rainfall, and irrigation on recovery of a soil damaged by the use of poor quality irrigation water, and (4) effect of atmospheric conditions under irrigation on plant growth and crop yield.  
Agron. 886

Oreg.

Frequency and Amount of Irrigation for Selected Crops. To (1) establish effects of various moisture levels, fertility levels, and other cultural practices alone and combined on production and quality of selected crops; (2) investigate relationships of meteorological factors and water use rates of crops grown under various moisture tensions, fertility levels, and cultural practices; and (3) continue study of relationship between meteorological factors and water use ratios in variety of climatic areas.

Soils, Agr. Engin., Hort., Field Crops 179 (W-29)

Pa.

Supplemental Irrigation for Maximum Production of Agronomic Crops. To learn (1) effect of interaction between crops and soil management on frequency and amounts of supplemental irrigation required for maximum production, (2) effects of supplemental irrigation on yield and quality of agronomic crops, (3) extent to which need for supplemental irrigation may be obviated by selection of drought tolerant varieties.

Agron., Agr. Engin. 1152D, Coop. ARS

S. C.

Irrigation of Field Crops Under Different Tillage Methods of Utilizing Plant Residues, and the Effects of These Treatments of Runoff, Erosion, Soil Properties, and Yield. To learn (1) effects of irrigation under various tillage methods of handling plant residues on runoff, erosion, nutrient losses, yields, and soil properties; (2) effect of placement of N fertilizer under various treatments.

Agr. Engin., Soils 130, Coop. ARS

S. C.      Effect of Chemical Composition of Irrigation Water on Yield and Quality of Truck Crops and Tobacco. To learn (1) chemical composition of various sources of water used for irrigation and its relation to local soil and geological conditions, (2) effects on yield and quality of truck crops of chemical composition of water used by sprinkler method, (3) effects on yield and quality of tobacco of ions present in water used by sprinkler method, (4) effects on soil properties of chemical composition of irrigation water.

Agron., Chem. 84, Coop. SCS, FES, ARS,

Tex.      Supplemental Irrigation in East Texas. To determine (1) efficient methods of pumping, conveying, and applying water for supplemental irrigation in East Texas; (2) water intake rate of irrigated soils in East Texas and develop water application methods to prevent ponding and runoff; (3) optimum soil moisture and fertility levels of various soils for cotton, vegetables, forage crops, sorghum, corn and other crops at various stages of growth; and (4) interaction between soil moisture and fertility levels so fertility amendments and water applications may be more efficiently used by growing crops.

Agr. Engin., Agron., Hort. 842, (S-24)

Tex.      Effect of Irrigation Waters of Varying Quality and Salt Content Upon Chemical, and Physical Changes Taking Place in Trans Pecos Soils. To learn (1) chemical changes taking place in Trans Pecos soils resulting from long-time application of irrigation waters of various salt content, (2) relative structural stability of these soils to irrigation waters of different quality.

Agron. 1048

Tex.      The Effectiveness of Soil Amendments and Modified Planting Practices in Facilitating the Use of Highly Saline Irrigation Waters. To learn (1) effectiveness of various soil amendments on physical and chemical conditions of soils and crop growth under application of highly saline irrigation waters, (2) influence of various planting practices upon seed germination, crop growth, and soil conditions under saline irrigation.

Agron. 1049

Utah      Relation of Soil Moisture Regime and Nutrient Supply on Plant Nutrition and Soil Productivity. To (1) study effect of irrigation regime on soils and crops; (2) determine interrelationships of method of irrigation, soil moisture condition, and nutrient needs for crop; (3) study water needs of various crops as related to weather conditions; and (4) relate movement of water in soil to forces that retain water and to study ways of modifying these forces.

Agron., Irrig. and Drainage 306, (W-29)



Wash.

Factors Governing Stream-Size and Length-of-Run for Furrow Irrigation. To (1) determine the effect of soil structure--which changes with season, crop and tillage--on resistance to soil erosion in furrow irrigation; (2) develop criteria to define the critical soil conditions in a cropping system on which length of run should be based; and (3) develop criteria for furrow length design.

Agron., Agr. Engin. 1218, (W-28)

W. Va.

Factors Involved in the Use of Supplemental Irrigation Under West Virginia Conditions. To (1) learn amount and timing of supplemental irrigation for optimum crop yields and develop criteria to provide a practical farm method of scheduling time and amount of irrigation, (2) learn effect of fertility level on yield, botanical and chemical composition and plant growth characteristics of crops grown with supplemental irrigation, (3) calculate length and frequency of periods of rainfall deficiency at selected locations and establish the needs for water to be supplied by irrigation.

Agr. Engin., Agron. 92, (NE-22)

Wis.

Production of Vegetable Crops and Small Fruits Under Supplemental Irrigation. To (1) determine response of vegetable crops and small fruits to supplemental water; (2) devise cultural practices with vegetable crops and small fruits which will give maximum returns in yield and quality under supplemental irrigation.

Hort., Agr. Engin., Soils 913

#### D. DRAINAGE

Calif.

Drainage of Lands Under Irrigated Agriculture. To (1) develop and improve techniques for drainage investigation and evaluation of drainage problems, (2) develop criteria and methods for more rational design of drainage facilities through studies of hydraulic conductivity of soil for water and through direct or indirect methods of evaluating such hydraulic conductivity, (3) investigate efficiency and permanence of various types of materials and equipment used in drainage facilities, or in construction thereof, (4) investigate other phases of reclamation as related to establishing drainage criteria and the relationships between irrigation and drainage.

Irrig., Soils 1539, Coop. ARS, USDI-Bur. of Reclam.

Ind. Dynamics of Water Flow in Tile-Drained Land. (1) Study effect on flow when drain runs only partially full, (2) learn flow, and associated head loss, through spaces between tile, (3) study for a falling water table the effect of capillary fringe on flow.  
Agron. 884

Iowa Field Investigations of Subsurface and Surface Drainage. To (1) determine influence of existing tile drainage systems of several designs on water table levels and on crop yields; (2) determine effect of different design features on effectiveness of tile drainage by making experimental installations in various problem areas; (3) develop techniques for layout and installation of surface drainage systems, and make necessary surface drainage machine; (4) develop techniques and investigate materials which might be used for the stabilization of mole channels; (5) study possibilities of using combinations of tile, mole, and surface method in solving drainage problems; (6) study methods of farming over surface drainage systems; (7) make survey of permeability of various soil types as determined by field methods; (8) study effects of soil management and crop rotations on drainage; (9) determine how much soil temperatures are changed by drainage and determine effects of temperature changes on seed germination and plant growth, (10) present recommended design procedures and techniques in such a way as to facilitate use by field personnel; and (11) determine feasibility of subirrigation with drain tiles and drain tubes.  
Agron., Agr. Engin. 1003

Md. Effect of Drainage Upon Crop Yields, Farming Practices and Land Utilization. To (1) ascertain development of drainage (2) determine influence of drainage on yields, (3) ascertain changes in farm practices due to drainage, (4) determine shifts in land use as result of drainage, and (5) determine combination of conditions necessary for practical and profitable farm drainage.  
Agr. Engin., Agr. Econ. A-32-h, Coop. SCS

Nev. Evaluation of Factors Relative to Drainage of Lands Damaged by High Water Table Conditions. (1) Learn relative importance of causes for high water table problems in a representative 20 square mile study area. (2) develop methods and equipment for determining relative importance of various causes for high water table problems. (3) develop economically and physically feasible methods for correction of high water table problems in study area and in other similar areas.

Soils 26, Coop. ARS, USDI-Bur. of Reclam. (W-28)



N. Y.            An Investigation of Drainage Problems Under New York State Conditions, with Special Emphasis on Design Principles and Practices. To (1) determine the specific design problems as they exist in New York State; (2) investigate these problems with the aim of determining adequate design criteria; (3) determine influence of various management practices upon design and maintenance requirements for drainage systems.

Agr. Engin., Agron. 38, Coop. ARS

N. C.            The Effects of Cultural and Management Practices on the Properties of Tidewater Soils and Their Effects Upon Crop Yields. To determine (1) effects of cultural and management practices and degree of drainage of excess water on corn yields and physical characteristics of Tidewater soil; (2) what sod crops can be grown under varying degrees of artificial drainage on poorly drained Bladen soil; (3) effects of different sod crops on water permeability of Bladen subsoils; (4) water distribution relationship in poorly drained Bladen soil under different cropping systems, and receiving different degrees of artificial drainage.

Soils 111, Coop. ARS

N. C.            Development of Criteria for Adequate Drainage and Their Application to Design Methods. (1) Evaluate relation between geometry of drainage systems, soil characteristics and soil moisture on subsurface drained land. (2) Study effect of water table behavior on plant growth. (3) Develop appropriate methods of measuring variables pertinent to a study of above objectives. (4) Ultimately, devise a rational method of designing drainage systems, considering weather uncertainties, crop needs and hydraulic behavior of soil-water complex. .

Agr. Engin., Soils 137, Coop. ARS

Utah            The Drainage of Irrigated Lands. (1) Develop methods for installing shallow drains (moles) and evaluate effectiveness of moles in solving drainage on heavy soils. Evaluate (2) relation of drainage problems to irrigated practices; (3) in field recent developments in drainage theory. (4) Develop instruments and methods for recording and interpreting drainage problems. (5) Continue to collect and record data regarding new and existing drainage facilities.

Engin. 285

Utah

Water Application and Hydrologic Factors in Relation to Drainage of Arid Region Soils. To (1) improve methods for measuring water-table fluctuations; (2) determine effects of weather elements, irrigation, consumptive use, and drainage on water-table fluctuation; (3) develop improved techniques for interpreting and evaluating water-table fluctuations and soil permeability and specific yields; (5) determine relation between water-table fluctuations and drainability of soils; and (6) develop improved methods of evaluating and correcting drainage problems.

Irrig. and Drainage 463, (W-28)

### E. STRUCTURE

Ariz.

Soil Structure as Affected by Soil Amendments. To clarify (1) basic causes of poor soil structure and restricted root growth and water penetration which frequently occurs in soils particularly under irrigated conditions; (2) relation between structure, replaceable bases, clay mineral types, and soil textures; (3) value of soil amendments in cultural program for irrigated amendments to problem soils and methods of application under field conditions.

Agr. Chem., Soils 369, (W-30)

Ark.

Studies on Physical Properties of Compacted Soil Layers and Their Effects on Plant Growth. To (1) learn nature and extent of compacted layers in Arkansas soils; (2) learn effect of compacted layers upon root growth and yields of certain selected agronomic crops; (3) study elimination methods of compacted layers.

Agron. 403

Calif.

The Susceptibility of Soils to Changes in Bulk Specific Volume and Pore Size, and the Effect of These Changes Upon Related Physical Properties. To understand: (1) bulk specific volume as function of particle size distribution under measured applied stresses; (2) influence of chemical status of soil and incorporated natural and synthetic amendments upon specific volume and pore alteration; (3) interrelationships of water content - energy function, particle orientation, bulk specific volume and soil composition; (4) stage in cyclical moisture changes in soil at which stresses are applied, as they affect alteration in bulk specific volume and pore size; and (5) alteration in soil physical properties other than those mentioned as a result of stress application.

Soils, Pl. Nutr. 1586, W-30)

Calif.

Soil Structure: Its Measurement, Modification and Influence Upon Soil Properties and Water Relationships.  
To aid the development of improved management procedure of non-saline and non-alkaline soils in which water penetration and growth problems exist.

Pl. Nutr., Soils 1590

Calif.

Procurement and Development of Instrumentation for Studying Stresses in Soils, Compaction and Infiltration.  
(1) Develop techniques and instrumentation for measuring strains, deformation, and characteristics of compacted areas, at depths below a surface subjected to known forces. (2) Produce pressure pans in various types of soils under various soil conditions and types of imposed loads. (3) Produce and study characteristics of filter pans. (4) Develop techniques and equipment for breaking up established pressure or filter pans and measure their behavior during and following the breaking up process. (5) Develop instrumentation for measuring factors affecting infiltration of water into compacted soils.

Agr. Engin. 1673

Calif.

Irrigation Management for Crops on Compact or Slowly Permeable Soils. (1) Study soil moisture content and other soil characteristics in relation to susceptibility of soils to compaction with particular emphasis on resultant infiltration rates; (2) causes of slow water penetration not attributable to compaction or Na. (3) Learn possible effects of mineral and organic amendments on soil structure and infiltration. (4) Study root development of crops in impervious soils, and relation of root development and root diseases to supply of available water (5) Evaluate systems of crop and crop residue management which may lead to a more adequate water supply to subsequent crops. (6) Evaluate from water supply viewpoint, crop responses to tillage methods. (7) Develop for slowly permeable soils criteria for land grading, irrigation water management and drainage so soils may be irrigated without plant injury from standing water. (8) Study accumulation of salts from irrigation water and fertilizer residues in relation to water penetration rates.

Irrigation 1673 C



Calif.

The Causes of Compacted and Impermeable Soils and Methods for Improving Their Structure, Productive Capacity, and Irrigation Management: Subtitle- Factors Influencing Soil Compressibility. (1) Learn relation between soil compressibility and particle size distribution, clay mineralogy, parent material, organic matter content, exchangeable cations, silica-sesquioxide ratio, etc. (2) Study relation between soil, management history, and development of poor physical conditions. (3) learn what laboratory and field tests are most suitable for evaluation of soil physical condition and develop means for interpreting results of tests. (4) Find means for reducing compressibility under specified conditions. (5) Study influence of type of clay and type of flocculating and cementing agent on soil physical condition.

Soils, Pl. Nutr. 1673 F-1

Calif.

Influence of Soil Compaction and Corrective Measures on the Growth, Yield, and Quality of Vegetables. (1) Develop plots with compacted layers of soil and use in comparison with adjacent uncompacted soils. (2) Study effects of such compacted soils on root distribution of vegetables. (3) Learn adaptability of different vegetable species and varieties to soils that have been compacted; (4) effect of normal cultural and harvesting procedures on development and possible correction of compacted soils; (5) influence of vegetable rotations on amelioration of compacted layers; (6) placement and irrigation practices that might produce high-quality vegetables on compacted soils.

Veg. Crops 1673 G

Colo.

Factors Affecting Soil Structure and the Relation of Structure to Plant Growth and Water Movement in Soils of the Upper Colorado River Basin. To (1) develop or test lab and field methods for measuring and characterizing soils with respect to size distribution, and geometrical configuration of primary particles, aggregates, and pore spaces in soils, and to study relationships between structural components characterized and plant growth; (2) study fundamental factors which affect formation and stability of soil structure such as primary particle size and amount, type of mineral in silt and clay fractions, moisture status, soluble salts, etc.; (3) develop or test methods to measure stability of structure of soils with emphasis on resistance to mechanical forces; and (4) study effect of organic matter, cultural practices, and chemical amendments on development and maintenance of stable soil structure.

Agron. 225, Coop. ARS, (W-30)

- Conn.            The Effect of Cultivation on Soil Physical Properties and Crop Yields. To study the effect of cultivation with tractor equipment on soil structure and crop yield compared with weed control by flaming, chemical methods and with a non-compacting experimental cultivation.  
Soils 714
- Conn.            Effectiveness of Woodchips, Digested Sewage Sludge and Other Waste Products for Improving the Structure and Productivity of Soils. To determine suitability of certain organic waste products such as woodchips, sawdust, digested sewage sludge, and garbage compost for improving the structure and productivity of soils.  
Soils 716
- Conn.            Effectiveness of Chemical Soil Conditioners in Improving Soil Structure. To study short and long term effects of chemical soil conditioners in improving physical condition of soils and to determine their suitability to Connecticut soil and cropping conditions.  
Soils 723
- Conn.            The Effect of Subsoiling on Soil Physical Properties, Root Growth and Crop Yields. To study effect of subsoiling, with and without lime and fertilizers, on: soil physical properties; growth and distribution of roots of corn, tobacco, and vegetables; crop quality and crop yields.  
Soils, Tobacco Lab. 725, (NE-11)
- Storrs  
(Conn.)        Effects of Cropping Systems on Soil Aggregation and Subsequent Effect on Aeration and Redox Potentials. To study (1) short and long term cropping effects on soil aggregation; (2) aeration and potential values as affected by aggregation; (3) nature of reduced substances occurring or accumulating under poorly aerated conditions.  
Pl. Sci. 222, (NE-11)
- Ga.              Physical Properties of Georgia Soils as Related to Cropping Practices and Yields. To determine effects of different cropping practices, particularly clean cultivated row crops versus pasture or forage crops on the physical properties of soils, including structure, water-holding capacity, infiltration, aeration, volume weight, specific gravity, organic matter, and any other properties which may be considered important.  
Soils, Agron. 46
- Hawaii        The Physical Properties of Soils 1. The Influence of Clay Minerals, Organic Matter, Particle Size Distribution, and Chemical Environment on the Susceptibility of Soils to Compaction and Slaking by Water. Evaluate influence of (1) clay minerals, organic matter, particle size distribution, and chemical environment on susceptibility of soils to compaction and slaking by water; (2) factors on shearing strength and breaking strength of dried soils.  
Agron. and Soils 133, (W-30)

Idaho

The Influence of Crop Rotation and Soil Management on Crop Yield and Physical Characteristics of the Soil. To determine (1) changes taking place in physical properties of soils under different crop rotation and management practices; (2) relations between physical properties of soil and crop yields; and (3) influence of structure on soil erosion as brought about by crop rotations and management.

Agron. 221

Iowa

Soil Structure and Crop Production. To (1) study methods of measuring soil structure and influence of structure upon factors affecting plant growth; (2) determine structural status of various soils; (3) study mechanism involved in structure formation; and (4) examine various ways of maintaining desirable soil structure.

Agron., Soils 1235, Coop. SCS, (NC-17)

Kans.

Effect of Soil Compaction on Crop Growth. Learn (1) effect of soil compaction on infiltration rate and on aeration; (2) effect of compact soil layers on root development and on crop growth; (3) relationship between physical measurements of soil and yield of crops.

Agron. 501, Coop. ARS, (NC-17)

Ky.

The Structure and Other Physical Properties of Kentucky Soils as Affected by Cropping and Soil Management Practices. To (1) determine permeability of soil profiles from representative soil types in Kentucky, (2) relate permeability of soils to other physical soil properties, and (3) study effect of cropping and other soil management practices on physical properties of soils.

Agron. 165

La.

Soil Structure Studies on the Rice and Sugar Cane Soils of Louisiana. To study (1) relationship between soil structure and growth of rice or sugar cane, and (2) methods of improving soil structure and soil aeration.

Crops, Soils 610



La. Soil Physical Conditions and Fertilizer Placement as Related to the Production of Cotton, Corn and Sugar Cane. To (1) determine extent and location of soil areas of compacted and impervious layers that restrict root penetration, (2) measure physical properties of the layers or horizons of the soil at a given location in terms of bulk density, pore size distribution, porosity, structural stability and permeability, (3) employ deep plowing, subsoiling, deep application of fertilizers to increase yields of crops on soils of undesirable physical characteristics, and (4) evaluate effects of subsoiling, deep plowing and fertilizer placement on the physical characteristics of the soil.

Crops, Soils 850

Maine Effect of Field Traffic and Maine Winters on the Physical Condition of Potato Soils. To (1) measure amount and depth of compaction that occurs in potato fields as a result of mechanical traffic; (2) study effect of Maine winters on resulting compaction; and (3) study effect of above factors on soil aggregation.

Agron. 36, (NE-11)

Md. Factors Affecting the Formation and Destruction of Soil Aggregates. (1) Evaluate effect of various cropping systems on water stability of soil aggregates. (2) Learn effect of high N fertilization with and without cover crops on water stability of soil aggregates under continuous corn. (3) Clarify relation between water stability of soil aggregates and: freezing and thawing, wetting and drying, method of determining water stability, porosity of aggregates, puddling, and heat of wetting.

Agron. 0-56, (NE-11)

Mass. Studies of the Usefulness of Soil Conditioning Materials in the Production of Tobacco Plantbeds. To ascertain effects that the use of soil conditioning materials in the production of tobacco plantbeds, may have on the growth of tobacco seedlings.

Agron. 8

Mich.

The Evaluation of Differences in Soil Structure and Organic Matter Due to Differences in Rotations and Other Cultural Practices. To (1) compare and evaluate methods to study soil structure and organic matter; (2) determine soil factors responsible for deficiencies in plant growth and yield; (3) improve old methods and develop new ones to better measure differences in soil structure and organic matter that are responsible for differences in plant growth and yield; (4) determine optimum values of soil factors, that can be measured, that are necessary for highest yields; and (5) determine rotations and cultural practices that best improve and maintain soil structure, and organic matter at optimum for highest yields.

Soil Sci. 22, (NC-17)

Minn.

The Effect of the Nature of Soil Structure on Soil Properties and Plant Growth. To (1) determine influence of soil physical condition on plant growth in important soils, and what structural condition should be maintained for maximum productivity; (2) evaluate present methods of measuring physical state of soils and determine effect of various cropping systems and cultural practices on soil structure as correlated with productivity; and (3) study mechanism of soil structure where appropriate in the above.

Soils 2517, (NC-17)

Miss.

The Influence of Cropping Systems on Soil Properties and Crop Production. Learn (1) effect of different crops in rotation with cotton on soil properties and on crop yields, (2) length of time various crops should be grown on a soil for optimum benefits, (3) residual effects of sod crops on soil properties and on cotton yields.

Agron. HU-2

Miss.

The Effect of Cultural Practices and Cropping Systems on the Physical Properties of Soils. To determine (1) effect of tillage methods on hard pan soils; (2) effect of tillage practices on fine clay soils; (3) effect of long-time use of winter legumes on physical properties of soils; (4) effect of different fertility levels and crop residues on physical properties of soils; and (5) moisture retention and transmission characteristics of Mississippi soils.

Agron., Soils HD-4



- Miss.            The Effect of Cultural Practices on the Physical Property of Soils. To determine (1) efficiency with which several deep tillage methods can be used to eradicate hard pans; (2) effect of tillage practices on physical properties of clay soils; (3) effect of long time use of winter legumes on physical properties of soils; (4) effect of intensity of secondary seedbed preparation; and (5) method of eliminating harmful effects of hillside seepage.  
Agr. Engin. HB-6
- Nev.            Modification of Soil Structure and Related Characteristics. Study effects of irrigation practices, cropping systems, and soil conditioners and surfactants on soil structure as indicated by aggregate analysis and observation; measure related water infiltration, permeability, granulation, consistency and modulus of rupture; note effects of soil conditioners on structure of soil surface and consequent seedling emergence; note effects of soil conditioners and deep tillage on structure of subsoils.  
Soil 19, Coop. SCS
- N. H.            Evaluation of Soil Physical Conditions that are Favorable to the Yield of Crops. To determine (1) effects of aggregate size upon yield of millet; and (2) certain physical properties of synthetic aggregates formed from quartz and orthoclase particles bonded by soil conditioners.  
Agron. 93
- N. H.            Effect of Tractor Weight on Soil Compaction. Learn effect of tractor weight, speed and drive wheel slippage on soil compaction at different moisture levels on representative New Hampshire soils.  
Agr. Engin., Agron. 108
- N. J.            Development and Maintenance of Improved Soil Structure in the Intensive Farming Areas of the New Jersey Coastal Plain. To (1) determine extent of structural deterioration of intensively-farmed Coastal Plain soils, causes for it, and means of overcoming it; (2) evaluate soil physical conditions by applying improved instrumental techniques and by measuring growth, yield, and market quality of vegetable crops; (3) evaluate several practical methods that can be used in overcoming bad structural conditions and in maintaining any improvement that can be effected.  
Soils 641, Coop. ARS, (NE-11)

N. Mex.

Soil Structure in Relation to Plant Growth and Chemical Properties of Soils. To (1) study relation of exchangeable sodium to physical and chemical properties of soils; (2) determine yield and chemical composition of alfalfa and other crops on sodium soils; (3) study influence of natural and synthetic soil amendments on structure of sodium soils and plant growth; and (4) correlate yield and chemical composition of crops with various indexes of soil structure.

Agron. 44 (W-30)

N. Y.

An Investigation of the Genesis, Stabilization and Quantitative Characterization of Soil Structure and of Its Practical Significance in Crop Production. To (1) find out nature of forces which bind soil particles together into "crumbs" and to improve lab methods for quantitative measurement of soil structure; and (2) study effect of structure upon drainage, aeration, and water retention of typical soils and determine ecological significance of these changes.

Agron. 54, Coop. ARS, (NE-11)

N. Dak.

The Effect of Tractor and Equipment Operation on Traffic Soles in Farm Fields. To learn (1) if traffic soles are in various soils and if they survive winter frost action under normal field conditions, (2) depth of soles and effect on water infiltration rates, (3) best soil moisture state for working soils to avoid soles, (4) effect of cultivation of row crops on soil compaction between rows.

Agr. Engin., Soils 45

Ohio

A Study of Soil Structure: Its Formation, Its Importance to Crop Production, and the Improvements Which May be Effected by Soil Management Studies. To (1) study reciprocal relationship between soil structure and root development and fundamental causes of this relationship, (2) determine influence of soil structure on plant growth and crop production and develop a system of measurement to characterize and evaluate soil structure relative to crop production, (3) study structures now found in Ohio and factors responsible for their development, (4) study effect of various cropping systems and cultural practices on soil structure to develop farming systems which can be profitable to the farmer and also maintain high productivity through improved soil structure, and (5) study in detail the mechanics and processes involved in movement of water and air in soils as affected by different soil structures.

Agron. 35

- Ohio            Chemical and Physical Properties of Soil Organic Matter. Learn: (1) chemical composition and structure of soil organic matter; (2) physico-chemical properties of soil organic matter; (3) mechanism of aggregate stabilization by organic matter.  
Agron. 77, (NC-17)
- Oreg.           Soil Structure: Its Alteration, Influence on Plant Growth and Measurement. To (1) test under greenhouse and field conditions, certain practices and amendments to obtain effects on plant growth, yield, and soil properties, (2) evaluate immediate and lasting effects of certain soil amendments on structure of different soils under laboratory conditions, (3) improve existing methods or develop new methods of evaluating soil structure.  
Soils 187, (W-30)
- Pa.             Soil Structure Problems in Pennsylvania Agriculture. To (1) develop, improve, and apply techniques for quantitative evaluation of structural conditions in soils, and determine what aspects of structure each method actually measures; (2) determine processes in deterioration and improvement of soil structure; (3) determine influence of different structural changes upon those several soil properties which may influence plant growth directly or indirectly; (4) determine influence of soil structure on growth of different plants; and (5) devise and evaluate practical means of restoring and maintaining desired structural conditions.  
Agron. 1166, (NE-11)
- P. R.           Soil Structure Improvement. To relate properties of various fractions or combinations of fractions of Puerto Rico soils to soil structure and to plant growth.  
Soils 77, (S-14)
- R. I.           Organic Matter and Soil Structure as Factors in the Renovation of Soils After Continuous Cropping with Potatoes. (1) Evaluate short rotations with redtop for the restoration of desirable structure in soils cropped with potatoes. (2) Learn fractions of organic matter involved in creation of desirable soil structure and increased yields of potatoes. (3) Study correlation between soil structure and potato yields.  
Agr. Chem., Agron. 1, (NE-11)



S. Dak.

The Importance and Evaluation of Physical Properties of (South Dakota) Soils as Influenced by Soil Management Practices. To (1) determine influence of cropping systems and plant species upon various physical characteristics of the soil, (2) determine interrelationship between physical conditions of soil and crop response to fertility, (3) determine effect of tillage practices on runoff, infiltration and storage of available water in soil, (4) determine effect of type of organic matter on structure of soils, (5) develop methods of measurement and characterization of physical properties of soils critical to crop growth, (6) evaluate physical characteristics of major soil areas, and (7) cooperate with other stations and USDA by participating in conferences and exchange of information.

Agron. 269, Coop. ARS, (NC-17)

S. Dak.

The Influence of Aeration and Mechanical Impedance on Crop Yields. Learn physical properties of soils affecting aeration, and mechanical impedance and tolerance limits of these physical properties as they influence plant growth. (1) Learn influence of moisture, colloidal clay, organic matter, and soluble salts on gas sorption by soils. (2) Relate established levels of aeration in the gas and liquid phase of root medium to plant growth. (3) Evaluate methods of measuring and characterizing physical properties of soils to learn ones most sensitive to plant growth.

Agron. 304, (NC-17)

Tex.

The Origin, Characterization, and Influence of Dense or Impervious Zones Upon Crop Production. (1) Study nature and composition of dense or impervious zones in irrigated soils of Lower Rio Grande and their influence on crop production. (2) Study influence of management practices as they affect development of compacted or impervious layers in irrigated soils. (3) Develop and improve methods and techniques for characterizing soil structural conditions which influence plant growth. (4) Develop soil-crop-water management practices that will alleviate or minimize incidence and influence of such zones.

Agron. 1021, Coop. ARS, (S-14)



Utah

Interrelationships of Soil Structure and the Edaphic Factors: Soil Moisture, Aeration, Resistance to Penetration and Temperature. To (1) devise satisfactory lab and field techniques to characterize and measure soil structural properties; (2) determine fundamental relationships between soil aeration, penetrability, moisture and heat; and (3) investigate combined effects of soil aeration, moisture, penetrability, and temperature on plant growth behavior.

Agron. 363, (W-30)

Wash.

Measurement of Soil Structure and Its Relationship to Other Physical Properties of the Soil. To (1) develop direct or indirect methods for characterizing soils with respect to size distribution and geometrical configuration of primary particles and of aggregates in the soils; (2) correlate static structure (or indirect measures of static structure) in homogeneous and in stratified soils and soil physical properties; (3) develop methods for measuring stability of soil structure under various treatments and consider effect on properties listed in 2; (4) apply such tools and techniques as may be developed to practical evaluation of soil properties and soil property changes as they relate to plant growth under lab, greenhouse and field conditions.

Agron. 874, Coop. ARS

W. Va.

Nutrient Availability in Relation to Soil Structure.

To learn effect of (1) soil structure on nutrient availability as measured by chemical and biological tests of availability and plant tests of nutrient absorption; (2) increased nutrient content on crop yields in soils with poor structure.

Agron. and General 106, (NE-11)

Wis.

The Influence of Organic Matter and Biologic Factors on Soil Aggregation and Tilth. To (1) evaluate and compare present accepted methods of studying soil aggregation, as affected by soil microorganisms; (2) ascertain role played by specific soil microorganisms; and (3) test soils of low productivity for degree of aggregation.

Bact., Soils 722

Wis.

Soil Structure: Its Evaluation by Air Permeability, Soil Air-Space Percentage, Soil Bulk Density, and Soil Aggregation Measurements. To evaluate, in particular, measurements of air permeability of soils, soil air-space percentages, soil bulk density and soil aggregation as indications of soil structure and effects of soil structure on plant growth.

Soils 909, Coop. ARS, (NC-17)

## II. CONSERVATION

Ala.

The Effect of Various Vegetative Covers, Rotations, Mulches, and Seedbed Preparation on Runoff Water and Soil Losses from Various Slopes. To determine effect of (1) 2-year rotation of cotton followed by rye grass and reseeding crimson clover the first year and sudan grass for hay or grazing the second year on runoff water and soil and nutrient losses from 5 percent slopes; (2) 3-year rotation of cotton followed by oats, fescue grass, and ladino clover the first year and fescue grass and ladino clover for grazing the second and third year on runoff water and soil and nutrient losses from 10 percent slopes; and (3) 2 levels of crop residue from corn and crimson clover returned to soil on runoff water and soil losses.

Agron., Engin. 320, Coop. ARS, SCS

Idaho

The Economic Effects of Soil Conservation Practices on Yields, Costs, Returns and Farm Income in the Palouse Wheat-Pea Area. To (1) measure economic effects of specific conservation practices, including a. legume, grass, and grass-legume rotations, b. fertilizer use, c. drainage of bottom lands, d. strip cropping, and e. subsoil cultivation; (2) measure effect of above practices on weed control costs and on weed populations as is considered feasible and practical; (3) add other conservation practices when they are used by farmers in the area; (4) obtain information on the physical inputs and outputs associated with these practices; (5) measure changes in farm income resulting from such practices or combinations thereof; and (6) additional objectives such as methods of using a simple system of records to increase farm earnings, reasons why farm earnings vary in wheat-pea area, more important measures of efficiency and organization affecting farm earnings, and application of the information to other sections of Idaho.

Agr. Econ., Agron. 237, Coop. SCS

Ill.

Runoff from Small Agricultural Areas in Illinois. To learn (1) peak rates and total amounts of runoff from watersheds of 25 to 1,000 acres; (2) comparison of runoff from watersheds under accepted soil conservation practices with watersheds cultivated without regard to soil conservation practices, (3) maximum rates of runoff in different soil association areas.

Agr. Engin. 10-312, Coop. ARS, SCS, USDI-Geo. Survey

Ill.

Effect of Planting Method, Slope, Crop, and Weather Conditions on Soil and Water Losses and Yields. (1) Learn effect of seasonal variations in weather on soil and water losses from land used in production of corn. Study (2) effect of slope on soil and water losses during production; (3) planting methods and their effect on soil and water losses and yields.

Agron. 40-332 (Dixon Springs)

- Ill.      Water Yields from the Lake Glendale Watershed. To (1) measure water yields as related to size and intensity of storms; (2) study water yields as related to topography, soil and cover type; and (3) determine total water yield in relation to annual precipitation on a forested watershed.  
For. 55-342
- Ind.      The Development of Land Use Equations for the Sloping Soils of Indiana. To (1) derive land use equations applicable to Indiana conditions, and (2) evaluate some of the newer practices such as mulch tillage and deep tillage.  
Agron., Agr. Engin. 784, Coop. ARS
- Iowa      Economic Aspects of Soil Conservation in Iowa. To (1) determine costs and returns of conservation practices and farm reorganizations to individuals, (2) analyze elements in economics of business firms and principles of production which condition profitability of individual practices and reorganizations, (3) estimate over-all market impacts and inter-regional adjustments in prospect of soil conservation, and (4) suggest desirable public action related to soil conservation.  
Econ. and Sociol. 1085, Coop. ARS
- Iowa      Physical and Economic Analysis of Watersheds as Related to Soil and Water Conservation. To (1) establish benchmarks of physical and economic conditions in a particular watershed to measure physical and economic changes; (2) develop methods to extend findings in test watershed to other watersheds in the state; (3) measure consequences of various land use practices, structure, etc., as to runoff, erosion, land productivity and soil moisture; (4) develop alternative physical means to achieve watershed objectives and appraise various measures; (5) develop physical and economic criteria for assessing costs among land owners, private interests and public agencies, to evaluate damages from watershed development; (6) develop and appraise alternative means to share benefits and costs.  
Agron., Econ. Engin. 1266, Coop. ARS
- Mich.      Sediment Transport in Runoff Water from Small Agricultural Watersheds. To determine concentration and quantity of soil transported in runoff water from small agricultural watersheds, and attempt to determine source of sediment carried in runoff.  
Agr. Engin. 806



Miss. Soil and Water Conservation Practices. To learn effect of various tillage and cultural practices on H<sub>2</sub>O intake and H<sub>2</sub>O storage capacity of soils, soil and H<sub>2</sub>O losses. To summarize data from State College Mississippi runoff and erosion station, study effect of mulch practices on H<sub>2</sub>O intake and available H<sub>2</sub>O storage capacity.  
Agr. Engin. HB-7, Coop. ARS

Mo. Soil and Water Conservation Management. To (1) determine under full soil treatment, best terrace spacing, grade, channel capacity and treatment, and extent to which point rows may be eliminated for major soil series in Missouri; (2) determine effect of terraces on power, labor, and machine costs in crop production and on yields; (3) investigate new designs of water management structures, to improve them and reduce costs; and (4) investigate use of land leveling for improved drainage of flat lands, elimination of field ditches and as a seedbed preparation method for farm crops.  
Agr. Engin., 43, Coop. ARS

Mo. The Effect of High Fertility on Runoff and Erosion.  
a. The effect of High Fertility on Runoff and Erosion from a Claypan Soil. To determine (1) effect of high fertility on runoff, soil loss, soil moisture and crop yield on claypan soil; (2) effect of crop residue mulch and sub tillage on runoff, soil loss and crop yield with continuous corn having high fertility treatments; and (3) relationship between runoff and soil loss from small fractional acre plots and from plots covering full length of slope.  
Soils 77, Coop. ARS

Mo. Effect of Forest Cover on Soil and Water Resources.  
(1) Hydrologic orientation: obtain, analyze, and interpret existing hydro-meteorological records to provide a sound basis for initiating and interpreting later, long-time studies on small drainage areas, (2) soil moisture studies: learn effect of timber cutting and surface soil condition on soil moisture, including observations of water table in shallow wells, interception of precipitation by trees and litter, evaporation, and transpiration, all of which are variables in hydrologic equation, (3) small watershed studies: determine influence of forest land-management practices on quality, quantity, and timing of runoff from paired experimental drainage areas including regimen of streamflow from undisturbed forest areas during initial standardization period of several years, effect of abusive watershed practices, and effect of restorative watershed practices.



- Mo.                    Reclamation of Eroded Soils. To find a means of bringing eroded subsoils back into agricultural production.  
Soils 209
- Mont.                Improvement of Dryland Tillage Equipment for Soil and Water Conservation. Improve dryland tillage implements and/or design new implements involving new principles of tillage in order to: keep stubble and trash on top of soil, reduce moisture loss during tillage operation, reduce power required, reduce wind and water erosion.  
MS 974, Agr. Engin. 28
- Nebr.                Effect of Crop Residues on the Surface and Other Soil Conservation Practices on Soil Erosion, Intake and Retention of Water and the Production of Crops. To study (1) fundamental factors involved in the phenomena of intake and retention of water by soils; (2) comparison of systems of soil culture and management with respect to their effectiveness in erosion control and moisture utilization and the interrelation of these to crop yields.  
Agron. 247, Coop. ARS
- S. Dak.              Economics of Soil Conservation on South Dakota Farms and Ranches. To determine to what extent, under various conditions, it is economically feasible for individual farmers to (1) substitute various legumes and grasses for row and small grain crops; (2) build various soil conserving structures such as terraces, grass waterways, dams, etc.; and (3) adopt other conservation practices such as contour plowing, planting, strip cropping, etc.  
Agr. Econ. 211
- S. Dak.              The Effect of Spacing on the Survival, Growth and Effectiveness of Windbreaks and Shelterbelts in South Dakota. To determine (1) spacing distance that best promotes tree survival, growth and longevity; (2) effect of spacing on soil moisture and nutrient supply in windbreak; (3) influence of spacing on wind reduction and snow accumulation patterns; and (4) cost of establishment and maintenance of each spacing design as a guide to finding an economic spacing consistent with maximum protection benefits.  
Hort. 239

Tex.

Land Use Adjustments in the Blackland and Grand  
Prairie Areas of Texas. B. On Cooperating Farms.

To (1) develop basic farm management data to be used with experimental studies and data from farm units in evaluating proposed land use changes; (2) appraise results obtained by farmers attempting new enterprises and practices; (3) determine difficulties met by farmers in fitting new, improved practices into going systems of production; and (4) determine economic effects of all recommended practices on crop and livestock production and on farm income from data on controlled farm units and from cooperating farmers.

Agr. Econ. & Sociol. 835, Coop. ARS

Tex.

Conservation of Water and Soil by Use of Cropping  
Systems and Related Tillage Practices. To (1) determine effects of cropping systems and certain related tillage practices alone and combined with contouring, terracing and water spreading on crop yields, storage of available water in soil, and amount and stability of crop residues maintained on soil surface; (2) determine effects of crop residues, mulches, chemical additives and tillage practices on moisture relationships, soil structure, and organic matter; and (3) evaluate cropping systems and tillage practices to determine if they are feasible, economical and sound from long time agronomic view point.

Agron. 900, Coop. ARS

Utah

Development of a Method for Making Preliminary Hydro-  
logic Investigations Where Little Basic Data are Available.  
Develop methods and techniques for making rapid and economical preliminary hydrologic investigations to learn precipitation pattern and water yield of a watershed or river basin.

Engin. 503, Coop. ARS

Va.

Soil and Water Conservation in the Limestone Valleys  
and Upland, Piedmont and Coastal Plain Regions of Virginia.  
To determine the effect of (1) slope, type of crop, soil properties, cultural practices, and rainfall characteristics on soil and water losses, and (2) topography, size, and shape of drainage area, soil type, vegetative cover, and tillage on peak rates and total runoff; and their effect upon ground water intake and storage capacity.

Agron., Agr. Engin. 86010, Coop. SCS, ARS

Wash.

Economics of Conservation Farming in Pacific Northwest Wheat Areas. To (1) determine effect of various conservation practices and combinations of practices upon farm organization, farm investment, labor requirements and utilization, machinery and equipment use, and other inputs in farm production, and upon land use, crop yields, and production of farm products; (2) determine income potentialities of soil maintaining systems of farming compared with exploitive systems; (3) determine combination of conservation practices that, from the farmers' standpoint, is most economic for given areas under given circumstances; (4) appraise public benefits and other public aspects of conservation; and (5) ascertain problems involved in establishing and maintaining conservation systems, obstacles to their adoption, and ways and means which would assist in bringing about desirable conservation programs, including use of public inducements.

Agr. Econ., Agron. 759, Coop. ARS, SCS

### III. GENESIS, MORPHOLOGY AND CLASSIFICATION

#### A. Classification and Mapping

Iowa

Preparation of Soil Maps for Individual Farm Planning in Soil Conservation Districts and for Estimating Land Conditions by Various Physical and Political Subdivisions of the State. To (1) provide information about land conditions necessary in making adequate land use capability classification and in making predictions and recommendations on land use and soil management on individual fields and farms in farm planning activities of SCS in soil conservation districts; and (2) enable the Experiment Stations and SCS etc., to make more adequate estimates of soil management and conservation requirements in different areas of the state to use in developing or guiding various agricultural land programs.

Soils 1191, Coop. SCS, ARS

Iowa

#### Classification, Correlation and Mapping of Soils.

(1) Study various landscapes to learn kinds of soil and their relationships. (2) Classify and correlate the soils into taxonomic units, including series, types, phases. (3) Prepare county soil maps and reports describing units mapped and including information on their use, management, conservation, and productivity.

Agron. 1329, Coop. SCS



Iowa

Crop Yielding Capacity of Iowa Soil Types Under Different Soil Management and Fertility Levels. (1) Prepare productivity tables showing crop yield estimates for discrete soil units or soil types. (2) Make these available for use in intra- and inter-farm planning and adjustment. (3) Learn variation in production due to uncontrolled variables on different soils; use information in learning how farm production may be stabilized by minimizing yield variance of physical product. (4) Evaluate soil units for purposes of land valuation. (5) Help in pointing out additional research needs in soils, climatology, and crop and soil management.

Agron., Agr. Econ. 1377, Coop. SCS

Ky.

Classification, Characterization and Adaptability of Kentucky Soils. (1) Classify and map soils of state, (2) Study basic properties of soils in field and laboratory, (3) Predict suitability of soils for crops, as well as their behavior and productivity under defined management conditions.

Agron. 174

La.

The Relation of Field Classification of Soils of the Coastal Plains and Soils of the Lower Mississippi Flood Plain to the Physical, Chemical and Mineralogical Characteristics of the Soil Profiles. To (1) make detailed soil survey of parishes not yet surveyed in the Coastal Plains and lower Mississippi flood plain, (2) correlate field classification with detailed physical, chemical, and mineralogical studies of profiles of the series, and (3) study relation of soil type to field productivity and determine effects of cropping and field practices on changes in soil characteristics.

Crops, Soils 576, Coop. ARS, SCS, (S-14)

N. Y.

A Study of the Agricultural and Scientific Significance of Differences Among Recognized and Proposed Units of Soil Classification, and Mapping. Establish by systematic physical and chemical studies of closely related agriculturally important soils, the mean and variance of agriculturally significant characteristics of each and the significance of differences between them both from the standpoint of immediate practical application in agriculture and from the standpoint of scientific knowledge; also from records of land use, production, and systems of management on operating farms, the relative suitabilities for use and responses to different systems of management of these soil units under practical farming conditions.

Agron. 49

N. Y.

A Study of Physical Input-Output Functions for Development of Productivity Ratings of Soils of New York. Learn expected output of farm product per unit of physical management input for selected management systems on benchmark soils of New York.

Agron. 49-9, Coop. SCS

Oreg.

Improvement and Management of Oregon Pastures and Ranges.--1. Development of a Fundamental Vegetation-Soils Classification of Non-Forested Ranges in Oregon as a Basis for Range Improvement and Management. To (1) learn vegetation-soil relations which characterize habitat types of non-forested ranges of Oregon where sagebrush and/or rabbitbrush create forage production problems; (2) establish suitable vegetation-soil guides to habitat types for application in range improvement, management, and other research programs; and (3) learn patterns of change in vegetation and soils as aid in identifying habitat type of disturbed areas.

Anim. Husb., Farm Crops, Bot., Pl. Path., Soils,  
Econ. 160-1, Coop. SCS, (W-25) (See also Part 10.)

Tenn.

A Soil Survey of Tennessee to Help Determine Crop Adaptations and Management Requirements. Complete inventory of Tennessee soil resources by preparing standard detailed maps of all the counties. Characterize major soil types particularly in regard to those properties affecting productivity for important crops grown in state.

Agron., Soils 84, Coop. SCS, TVA

Utah

Classification and Characterization of Utah Soils for Improved Utilization. (1) Make critical field studies and reviews of important soil series and types, and collect soil samples from genetic horizons for lab study of chemical and physical properties. (2) Relate and integrate technical information obtained to an improved soil classification system. (3) Provide basic principles for predicting performance of soils that can be expected from prescribed soil management practices.

Agron. 317, Coop. SCS

Vt.

Classification of Coniferous Forest Tree Planting Sites Based Upon Soil and Physiography. To develop a classification of potential productivity of coniferous forest planting sites in Vermont based on an analysis of soil and physiographic conditions which exist in established plantations.

For., Agron. 50, Coop. SCS

- Va. Economic Classification of Land with Special Reference to Use. To make an economic land classification map of every agricultural county in Virginia; to check the accuracy and usefulness of each land classification map by economic and other appropriate studies and surveys; to experiment with economic land classes as a basis for establishing a stratified sample which will be used for developing a sample census of the state and for collecting other economic information on a sample basis.  
Agr. Econ. 86001

- Wyo. Land Classification and Valuation Based on Soils, Topography, Precipitation, Input, Gross, and Net Returns. To determine (1) which lands in dry land areas will give more profitable returns from cultivated crops, (2) beneficial effects of grass mixtures and pasture vs. alfalfa and hay on soil fertility and net income per acre on irrigated projects, (3) net income from grass meadows vs. cash crop lands on irrigation projects, and (4) approximate yield of wheat per acre when animal carrying capacity is known and the topography of soil is favorable for farming.  
Agr. Econ. 499

## B. Morphology; Chemical and Physical Characteristics

- Ala. The Relationship of the Chemical, Physical, and Mineralogical Properties of Selected Soils in Alabama to Crop Production and to Their Soil Survey Classification. (1) Identify and quantitatively learn the crystalline and amorphous components of selected Alabama soils. (2) Characterize components through a determination of their chemical, physical, and morphological properties. (3) Relate characteristics to plant growth and to soil classification. (4) Study changes needed in soil classification scheme to provide a closer relationship with soil characteristics, so soil survey information in State will be most useful in land-use planning.  
Agron., Soils (inactive)
- Ariz. Nutritional, Chemical, and Physical Studies on the More Important Soil Types in Arizona. To study the correlation between soil classification and chemical, physical, and nutritional properties of Arizona soils.  
Agr. Chem., Soils 265, Coop. SCS



- Conn.      The Genesis and Morphology of Connecticut Soils and Their Relation to Land Use. To determine amounts and kinds of minerals in the clay, silt and sand fractions, and their relationship to natural soil structure and soil profile development.  
Soils 715, (NE-11)
- Ga.      The Influence of Chemical, Physical and Mineralogical Properties of Soils on Their Structure and on Plant Growth. To determine chemical, physical and mineralogical properties of several agriculturally important Georgia soils and their relation to soil development and soil productivity.  
Agron., Soils 312, (S-14)
- Idaho      Morphology and Chemical Characterization of Idaho Soils. To (1) describe morphologically the major soil series within physiographic areas of Idaho, (2) chemically and physically characterize those major soils within these physiographic areas, (3) integrate basic information on the major soils of the state, (4) map out important physiographic areas of Idaho, (5) provide analytical data to characterize official soil samples needed to support soil surveys and correlation of soils in Idaho by the AES and SCS.  
Soils, Agr. Chem. 248, Coop. ARS
- Idaho      Inventory and Characterization of Slick Spot Soils. To (1) delineate slick spot-affected areas on basis of physiographic units; (2) assemble all available data on morphological, chemical, and physical characteristics of slick spot soils for study; and (3) attempt to determine conditions causing formation of slick spots so as to aid in reclamation.  
Agr. Chem., Agron. 265, Coop. ARS
- Ill.      Characteristics and Distribution of Selected Soils Derived from Loess in Northwestern Illinois. Learn (1) distribution of Gray-Brown Podzolic and Brunizem soils with different degrees of subsoil development in northwestern Illinois; (2) chemical, physical, and mineralogical characteristics of selected profiles to learn their influence on various soil properties. (3) Trace development of soils in northern section of region by studying changes due to weathering and compare to similar changes in southwestern section and possible similar changes in southeastern section.  
Agron. 15-362, Coop. SCS

Minn.

A Study of Physical, Chemical, Mineralogical, and Morphological Characteristics of Prominent Soil Materials and Soil Types in Minnesota, and Soil Management Practices Essential to Their Best Utilization. To (1) characterize parent materials for various Minnesota soils, (2) evaluate the morphological, chemical, mineralogical, and physical characteristics of the principal soil types of the Anoka San Plain region as they relate to their formation and the development of sound soil management practices, (3) determine the morphological, chemical, and mineralogical properties of the principal Gray Wooded soils in Minnesota to more fully characterize them, correctly classify them, and facilitate their proper use and management.

Soils 2513

Minn.

Physical, Chemical, and Morphological Studies of Minnesota Organic Soils as Related to Their Classification and Utilization. Study physical, chemical, and morphological properties of various organic soils in state and evaluate these relative to their classification and utilization.

Soils 2522, Coop. SCS

Nebr.

Mineralogical, Physical and Chemical Properties of Nebraska Soils in Relation to Their Genesis, Classification and Mapping. To (1) obtain mineralogical, physical and chemical data as a background for a more complete classification and mapping of soils, (2) learn the limits of the morphological units of important soil profiles, and (3) suggest theories for the genesis of soils from the data obtained.

Agron. 264

Nev.

Soil Characteristics Related to Crop Productivity in Nevada. Note morphology and physical properties of major soil groups of Nevada, including depth, thickness, texture, structure, and consistence of different horizons for various soils studied; obtain data on chemical properties and fertility levels (organic matter content, total N, reaction, amounts and kinds of salts, base exchange capacity, levels of total and available nutrients); note geography, slope, drainage, and climate.

Soils 17, Coop. SCS

N. J.

Inventory of Physical, Mineralogical and Chemical Properties of Major Soil Series in New Jersey. (1) Inventory physical, chemical, and mineralogical properties of the major soil series in the state. (2) Acquire soil data useful in design and operation of irrigation and drainage systems. (3) Supply soil survey information on normal variability in physical condition that may be expected within soils with very similar morphologies.

Soils 626, Coop. ARS, SCS

- N. J.            A Study of the Origin, Development, Characteristics and Classification of New Jersey Soils. To provide quantitative data to assist soil surveyors and soil correlators in making decisions and furnish information on soils already delineated.  
Soils 638
- N. Y.            A Study of Physical and Chemical Properties of Soils of Cortland and Greene Counties, New York. Measure quantitatively soil characteristics that can be appraised only qualitatively by field methods as a firm base on which to build soil use and management recommendations.  
Agron., Soils 49-6, Coop. SCS
- N. Y.            A Study of Physical and Chemical Properties of Reference Profiles of New York Soils. Characterize chemically and physically reference soil profiles as supporting data for interpretation of basic agronomic research and for soil classification.  
Agron. 49-8, Coop. SCS
- N. C.            Genetic Relationships Between the Red-Podzolic and Yellow-Podzolic Soils in the Piedmont Region of North Carolina. To (1) determine factors responsible for differentiation of Red and Yellow Podzolic soils; (2) formulate generalizations as to processes involved and factors responsible for them for predictive value of soil genesis, classification, and management of soils; and (3) characterize chemical, physical, morphological, and mineralogical properties of soils.  
Agron., Soils 121
- Okla.            Basic Physical, Chemical and Mineralogical Properties of the Major Soil Series and Types in Oklahoma. To (1) determine the types and relative amounts of the several clay minerals in the soil profiles of the major soil series in the states; (2) determine the exchange capacity and exchangeable ions of the major soil series; (3) study the rate of release of these exchangeable ions; (4) more clearly elucidate the forms of phosphorus compounds present and obtain information on the release of phosphorus; (5) study soil organic matter and the release of nitrogen, sulfur and phosphorus from organic matter and the rate of organic matter decomposition; (6) study the relationship of organic and inorganic colloids; (7) determine the potential mineral nutrient content of the major soils series and types.  
Agron. 868, Coop. SCS, (S-14)



Utah

Development, Morphology and Mineralogy of Range and Forest Soils. (1) Make detailed chemical, physical, and mineralogical studies of genetic horizons of some representative profiles. (2) Study interrelation of climate, parent material, and soil profile development. (3) Learn proportions and types of clays present. (4) Study conditions and effects of vegetative succession as related to changes in soil profile.

Agron. 489, Coop. SCS

Va.

Mineralogical, Chemical, and Physical Properties of Representative Soils in Virginia. To (1) identify and determine quantitatively the crystalline and amorphous components of representative soils of Virginia; (2) characterize these components through determination of chemical, physical and mineralogical properties; and (3) relate soil properties to soil genesis, soil structure, and plant growth.

Agron. 86034, (S-14)

Wash.

Halomorphic Soils of the Chernozemic Zone in Washington. Locate areas with significant acreage of Halomorphic soils in Chernozemic Zone; select type field examples to represent each important combination of major soil forming processes which results in formation of Halomorphic soils; study physical, chemical, and mineralogical properties of profiles produced by each of combinations of process selected.

Agron., Soils 1279

W. Va.

Some Chemical Properties of the Major Soil Types of West Virginia. To (1) secure information on chemical properties of about 100 major soil types of West Virginia which may be useful in developing recommendations for soil treatment to increase land productivity; and (2) study interrelationships among chemical properties studied with a view to developing logical schemes for expressing these interrelationships as an aid in making soil treatment recommendations.

Agron., Gen. 81, Coop. SCS

## REGIONAL PROJECTS

NC-17

Value of Organic Matter and Soil and Crop Management Practices in Improving Soil Structure and Productivity. (1) The evaluation of physical conditions of soil that are favorable to the yield of crops; and (2) the evaluation of the chemical composition and reactions of organic matter that affect structure and productivity.

Cooperating stations: This section: Iowa, Kans., Mich., Minn., Ohio, S. Dak., and Wis. I-E;

Section a: Ill. I-B and Ind. II-D; Section b: Nebr. II-C, and S. Dak. II-F.

NC-40

Water Infiltration Rate Methods and Determinations on Soils. (1) To develop and field test practical methods for determining and predicting relative infiltration rates of soils during irrigation and during rains. (2) To determine infiltration rates for certain soil types under various management practices.

Cooperating stations: This section: Iowa I-A.

No other contributing projects under Federal-grant support.

NC-46

Measurement of Physical State of Water in Crop Plants. (1) To develop theories which describe the absorption by and flow of water through plants. (2) To develop methods for measuring and to measure the energy status of water in crop plants. (3) To develop methods for measuring and to measure the water transmission characteristics of crop plants.

Cooperating stations: This section: Nebr. I-B.

No other contributing projects under Federal-grant support.

NE-11

Soil Structure Problems in Northeastern Agriculture. To (1) devise and evaluate practical means of identifying, creating and maintaining desirable physical conditions for crop production in Northeastern soils; and (2) to determine in what ways soil structure influences the growth and nutrition of plants.

Cooperating stations: This section: Conn. (Storrs), Conn., Maine, Md., N.H., N.J., N. Y., (Cornell), Pa., R. I., and W. Va. I-E; Conn. III-B. Section a: Del. II-D; Section b: N. H. II-B.

NE-22

Soil-Plant-Water Relationships as a Basis for Irrigation. (1) To study water supplies for irrigation, including the development of sources and evaluation of quality. (2) To formulate a practical system for determining when and how much to irrigate, employing consumptive use, weather records and soil moisture measurements. (3) To determine the equipment requirements and performance based on crop needs and soil properties; and supplemental uses of irrigation equipment. (4) To measure crop response to irrigation in terms of yield and quality as influenced by the interaction of irrigation with other cultural practices.

Cooperating stations: This section: Pa. I-A; Conn. (Storrs), Conn., Del., Md., N. H., N. J., R. I., Vt. I-B; Maine, Mass., Pa., W.Va., I-C; see part 3a for N. Y.

S-14

The Influence of Chemical, Physical and Mineralogical Properties of Soils on Their Structure and on Plant Growth.

(1) To devise means of separating the crystalline and amorphous components of selected representative southern soils; (2) identify and determine quantitatively the various crystalline and amorphous components, including total organic matter; (3) to characterize these constituents through a determination of their chemical, physical and mineralogical properties; (4) to compare the reactions of these components in natural and in artificially prepared mixtures; and (5) to relate these soil properties to soil structure and to plant growth.

Cooperating stations: This section: P. R., Texas I-E; La. III-A; Ga., N. C., Okla., Va. III-B. Section a: Ark., Fla., Miss., Tenn., Texas I-C. Section b: Ky. I-E.

S-24

Development and Utilization of Water Resources for Agriculture. (1) To investigate methods of developing and improving sources of water for agricultural uses. (2) To determine moisture requirements of crops and evaluate crop response under different moisture regimes.

Cooperating stations: This section: Tenn. I-A; Ga. I-B; Miss., Tex. I-C; See part 3a for Ga., P. R. and S. C..

W-28

Dynamics of Water Flow in Saturated Soils, and Its Application to the Engineering Design of Drainage Systems. To improve engineering practice in drainage design through an increased understanding of the physical principles of flow of water through saturated soil.

Cooperating stations: This section: Calif., Oreg. I-A; Colo., Idaho, Mont., Wash. I-C; Nev., Utah I-D. See part 3a for Oreg. and Wyo



W-29

Soil-Water-Plant Relationships Under Irrigation.

(1) To evaluate the influence of different systems of water management on plant growth and on soil in relation to fertilization, salinity and cropping practices. (2) To determine the relation of soil moisture conditions to nutrient uptake, physiological responses and plant growth. (3) To study the soil water system including soil moisture energy relations, water retention characteristics and the principles involved in infiltration, unsaturated flow and vapor transfer. (4) To develop improved techniques and instruments to measure soil moisture. (5) To investigate the factors affecting the rate of water use by crops.

Cooperating stations: This section: Oreg., Wash. I-A; Calif., Mont., Wyo. I-B; Oreg., Utah I-C. Section b: Colo., Wash. II-F.

W-30

Measurement, Evaluation, and Modification of Soil Structure. (1) To develop and test direct or indirect laboratory and field methods and techniques for characterizing, measuring, and evaluating soil structure. (2) To investigate the interdependence of static and transitory structure with the edaphic factors: soil moisture, aeration, resistance to penetration, and temperature. (3) To determine the effect of chemical properties of soil on structure. (4) To evaluate the interrelationships of natural and synthetic soil amendments and soil structure. (5) To investigate the effect of tillage and other mechanical forces on soil structure. (6) To apply promising methods and techniques to the practical evaluation of soil structure and its changes as related to plant growth and soil and water conservation.

Cooperating stations: This section: Mont. I-A; Ariz., Calif., Colo., Hawaii, N. Mex., Oreg., Utah I-E.

W-32

Hydrology and Water Utilization of Small, Semi-Desert Drainage Areas. (1) To determine the amount of surface runoff available for diversion or storage. (2) To evaluate the hydrological characteristics of small, demi-desert watersheds. (3) To provide a basis for estimating costs for use of flood water to recharge groundwater reservoirs.

Cooperating stations: This section: Colo. I-A; Calif. I-B. Section b: Wyo. II-B. See part 3a for Ariz., Idaho, Mont. and Utah.



LIST OF COMPILATIONS OF FEDERAL-GRANT RESEARCH PROJECTS  
AT STATE AGRICULTURAL EXPERIMENT STATIONS

ARS-23-8:		
Part :	Subject-Matter Area	Title of Section
Numbers :		
1	Agricultural Chemistry	Agricultural Chemistry
2	Agricultural Economics	a. Prices, Incomes, & General Studies of Com- modities & Industries b. Farm Management c. Land Economics d. Farm Finance & Taxation
3	Agricultural Engineering	a. Land & Water Use & Develop- ment b. Power Machinery & Equipment c. Farm Structures & Materials
4	Animal Husbandry	a. Beef Cattle b. Sheep & Goats c. Swine
5	Dairy Husbandry	Dairy Cattle
6	Dairy Technology	Dairy Technology
7	Entomology & Economic Zoology	a. Field Crop Insects b. Fruit, Nut & Vegetable Insects c. Miscellaneous Insects & Economic Zoology d. Insecticides
8	Field Crops	a. Cereal Crops b. Oil, Fiber, Tobacco & Sugar Crops
9	Food Science & Technology	a. Food Chemistry, Micro- biology, Sanitation & Public Health b. Food Engineering, Processing, Product and Process Develop- ment, Utilization and Waste Disposal c. Food Quality & Standards, Acceptance, Preference, & Marketing
10	Forage Crops, Pastures & Ranges	Forage Crops, Pastures & Ranges
11	Forestry	Forestry



ARS-23-8:		
Part :	Subject-Matter Area	Title of Section
Numbers :		
12	Fruits & Nuts	Fruits & Nuts
13	Home Economics	a. Human Nutrition b. Housing c. Clothing & Textiles d. Foods-Consumer Quality & Utilization e. Household Economics & Management
14	Economics of Marketing	a. Field Crops b. Fruits & Vegetables c. Livestock, Meats & Wool d. Dairy Products e. Poultry & Poultry Products f. Forest Products & Ornamental & Drug Plants g. Cross-Commodity & Functional Studies
15	Meteorology	Meteorology
16	Ornamental & Drug Plants	Ornamental & Drug Plants
17	Plant Pathology & Bacteriology	a. Plant Pathology, Botany, & Diseases of Miscellaneous Crops b. Diseases of Field Crops c. Diseases of Fruit Crops d. Diseases of Vegetable Crops
18	Plant Physiology & Nutrition	Plant Physiology & Nutrition
19	Poultry Industry	Poultry Industry
20	Rural Sociology	Rural Life Studies
21	Soils	a. Soil Chemistry & Microbiology b. Soil Fertility, Management & Soil-Plant Relationships c. Soil Physical Properties, Conservation & Classification
22	Vegetables	a. Vegetable Crops b. Potatoes
23	Veterinary Science	Veterinary Science
24	Weeds	Weed Control



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